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The Welding Engineer

MARCH, 1946

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The Welding Engineer

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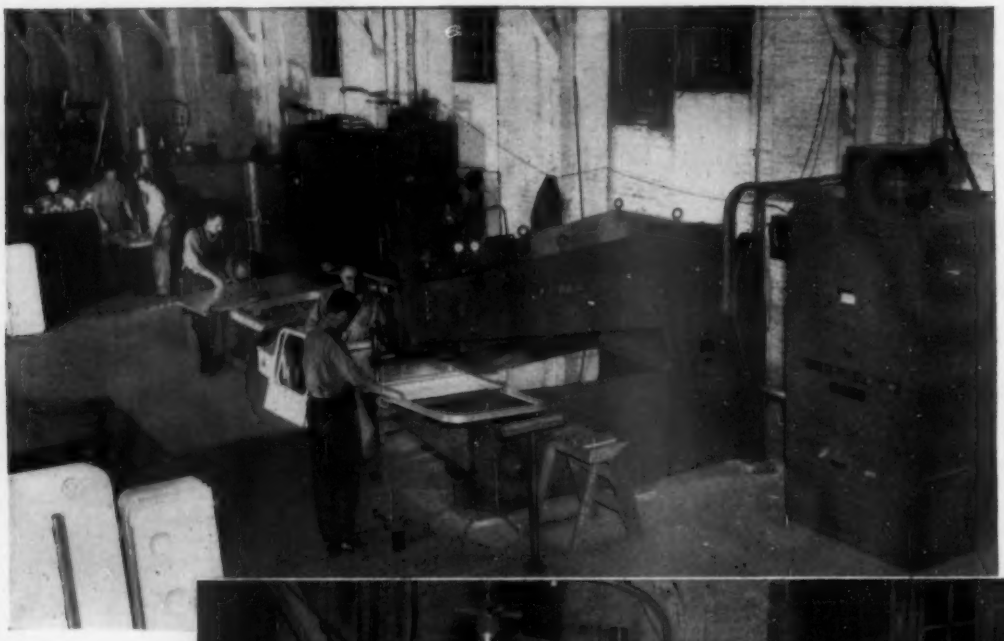

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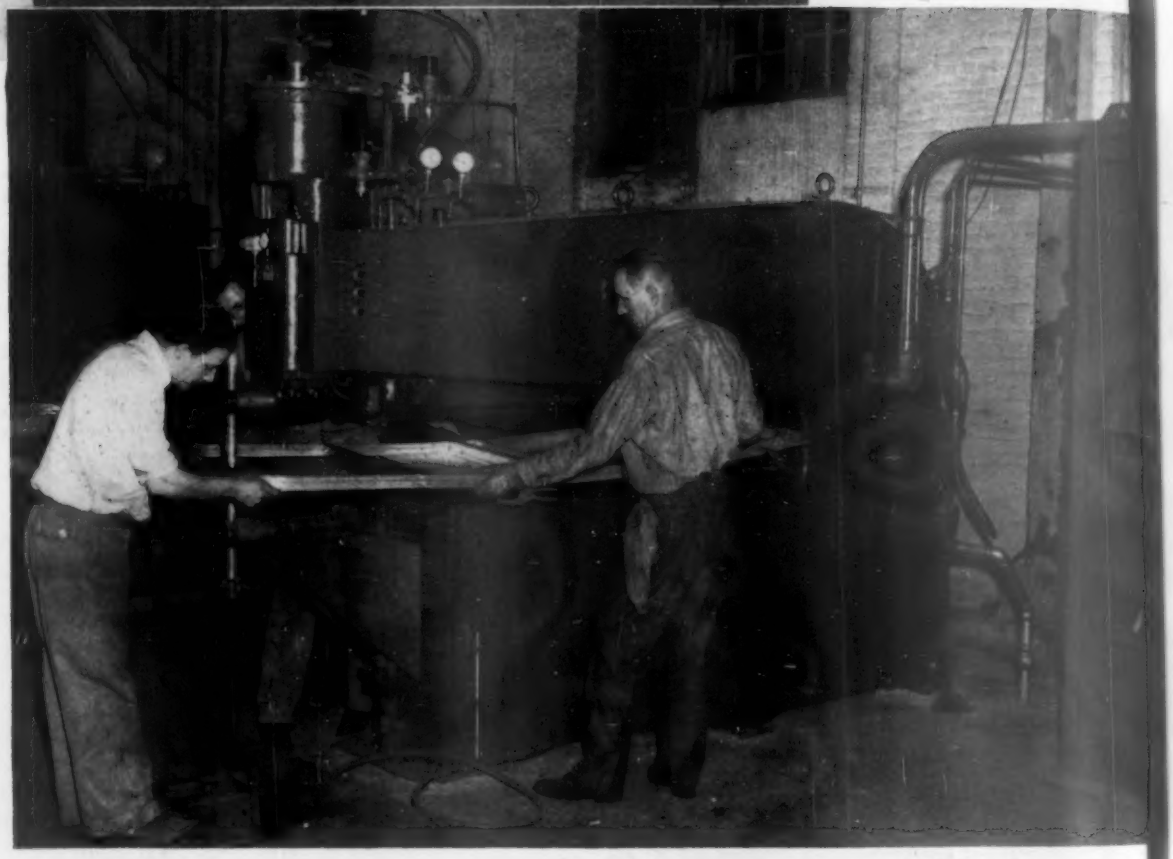


ABOVE at top is a view in the ACF Brill Motors Company plant showing Federal Welders in production. 54" Federal is in the rear . . . Closeup shows a full extra-length aluminum door being completely welded in the new Federal 84" Spot Welder.

THE Federal MACHINE

PRODUCTION

Welding Turbo-Jet Engines

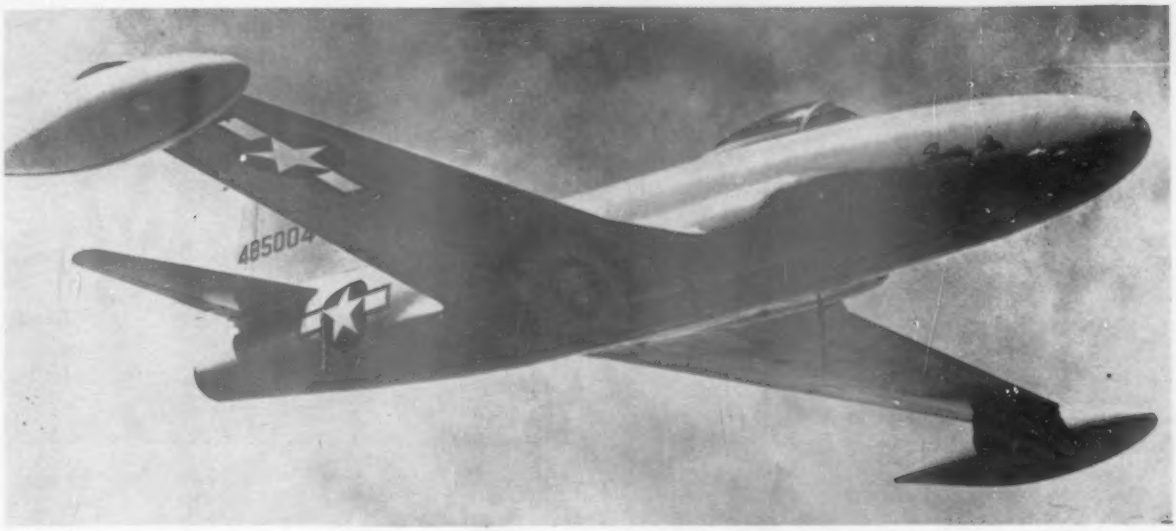


Fig. 1—Lockheed "Shooting Star" (P-80) in flight. One of the war's last developments, this plane is powered by the Type I-40 G-E gas turbine described in the accompanying text.

New austenitic stainless alloys had to be evolved for jet aircraft, and one of our major production feats was to develop suitable methods of welding them. Spot, seam atomic-hydrogen and metal-arc welding were all employed.

By W. J. CAMPBELL
Electric Welding Div., General Electric Co.

ALMOST all types of welding are being used to great advantage in the production of the G-E Type I-40 aircraft gas turbine used to power the Lockheed P-80 or "Shooting Star" (Fig. 1). This turbo-jet engine generates better than two horsepower per pound of engine weight as compared with about one horsepower per pound in a reciprocating engine. Welding helps greatly in obtaining this extremely favorable power-to-weight ratio.

Gas Turbine Drives Compressor

The thrust delivered by the I-40 is developed by the expansion of hot gases through the jet nozzle. These gases are the products of combustion of fuel and air, which occurs in the combustion chamber. The air is supplied by the compressor, which is driven by the gas-turbine wheel. The turbine wheel in turn is driven by the hot gases which impinge on it. All of the gas passes through the turbine wheel, but only part of its available energy is used to drive the turbine, the remainder being used to produce the jet thrust.

Since the intense heat of combustion creates very high operating temperatures (about 1,500 F), heat-resistant austenitic alloys are required for the combustion chamber and exhaust unit. In order to keep the weight of the engine down, these heat-resistant alloys are used in sheet form. Some sheets are as light as 0.022 in. in thickness.

Austenitic stainless alloys give high strength and good corrosion resistance at high temperatures. By welding parts formed of these alloys, the engineer was able to design for minimum weight with maximum joint efficiency in both thermal strength and physical strength. Being austenitic, these alloys are non-heat-treatable, and in addition they are "stabilized" alloys. Since they are non-heat-treat-

Fig. 2—Placing combustion tubes into fixture for the assembly of a turbo-jet engine.

Fig. 3—Welding of the cross-over tubes to the flame tubes is done by the atomic-hydrogen process. The ends of the tubes are joined to the rings by metal-arc welding.

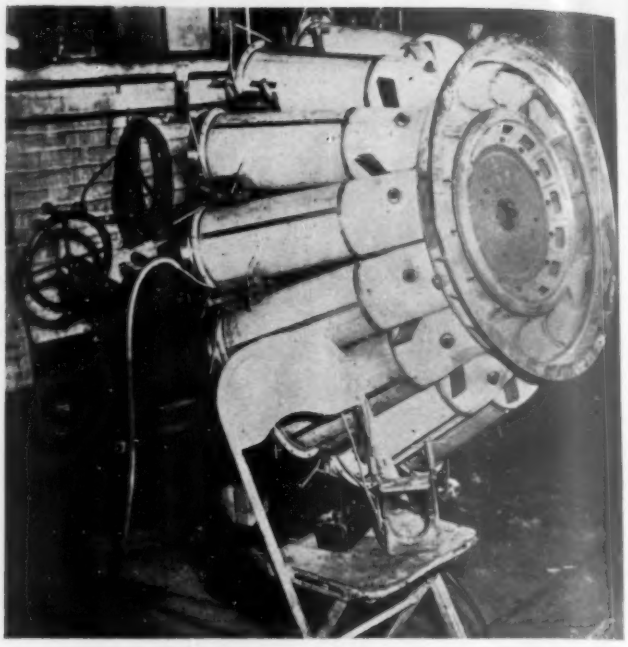


Fig. 4—Ring and tubes for aircraft gas turbine, as assembled with hydrogen backing fixtures in place. One of the latter fixtures is also shown on the chair.

able, no increase in hardness or loss in ductility occurs from the heat of welding, and as they are "stabilized" alloys there is very little loss of corrosion resistance when the parts are welded.

There are over five hundred welded joints in the I-40, most of which are on sheet-metal parts. Naturally, this presents the serious problem of distortion, a problem made even more difficult to control by the higher coefficient of expansion of stainless alloys. Only through close coöperation between the design engineer, manufacturing department and welding engineer was a satisfactory procedure established for the fabrication of the sheet-metal parts.

Joint Design Procedures

Before fabrication could be begun, it was necessary to make a thorough study of the fabrication problems covering procedures for joint design, fixturing, welding and machining. In considering joint design, it was first necessary to design for strength. Then weight, distortion and gas flow were checked very closely. Take, for example, a joint in which it is necessary to join pieces of different thicknesses. Minimum weight would be achieved by using a straight butt joint. A joint of this type, however, would set up a stress concentration in the thinner piece, and this would encourage failure in service. Fusion welding of a butt joint would also cause greater distortion. Therefore, a lap joint is used where the flanges are welded to the exhaust casing or the ring holders as well as to the flame tubes. The weld, moreover, is generally made by resistance seam welding. Such a joint is tight and has excellent strength, a minimum of distortion and a neat appearance.

Where the variation in thickness is great, fatigue failure may occur in the thinner section next to the lap. It is, therefore, always desirable to keep both pieces as closely as possible to the same thickness.

Welds Backed with Hydrogen

The longitudinal seams, in some instances, are designed to provide a flush joint without the necessity of grinding. These joints are made by using atomic-hydrogen welding to join pieces previously clamped in a fixture. To insure bead uniformity on the underside, the joint is backed up with hydrogen. The hydrogen backing is provided by burning hydrogen gas in a groove milled in the backing bar of the fixture.

On thickness up to 1/16 in. it is possible to butt the edges up square and, using the fixture as mentioned, weld the seam without the addition of filler metal or the use of flux. The result is a nearly flush joint, one that doesn't require cleaning and which has excellent physical strength.

The need for filler material is eliminated by clamping both sheets tightly within ¼ in. of the edges along the joint. The heat of the atomic-hydrogen arc causes the metal to expand and upset the sheets along the joint. The upset portion is then melted down to produce a flush weld. The metal contracts a little between the clamps as it cools, but this is so slight that it has scarcely any effect on the strength of the joint. In cases where a fillet weld is necessary between sheet stock and a heavier section, the metal-arc process is sometimes used to good advantage.

Distortion caused by welding is

Fig. 5—Close-up of circumferential seam welding of a large flange to the cone assembly.

Fig. 6—Nozzle diaphragm for gas turbine. Note the large amount of arc welding.

practically unavoidable in sheet-metal parts. Therefore, provisions must be made for possible distortion and its reduction where necessary by proper fixtures and sequence. In some cases, the welding sequence can be used to reduce distortion and the machining sequence to correct it. By carefully planning the operations in the manufacture of the I-40 engine, it was possible to make uniform and interchangeable parts despite the many problems encountered in welding sheet metal.

Combustion Chamber Assembly

The most complicated assembly of the unit is the combustion chamber. Fig. 2 shows the flame tubes being assembled in the fixture, together with the inner and outer ring. Fig. 3 shows an operator welding the cross-over tubes to the flame tubes by the atomic-hydrogen process. The other operator in this picture is metal-arc welding the ends of the tubes to the rings. In Fig. 4 the completed assembly is seen before removal from the fixture.

The discs shown in the foot plates in Fig. 2 are removed after tacking is completed, as shown in Fig. 3. This allows unrestricted expansion in the direction of the foot plates. The circle of foot plates is set out to compensate for the contraction of the tube circle after the cross-over tubes are welded. The contraction causes the assembly to spring in when it has been removed from the fixture. The distortion may vary from one unit to another; *i.e.*, one operator may make each weld with no mishaps, while another may have a hole and spend considerable time in repairing it, thus causing more than normal distortion.

The assembly is checked on a go or no-go fixture and if found acceptable, it is then set up in a boring mill for machining of the rings. The details of the fixtures used for providing hydrogen gas backing are shown in the fixture on the chair in Fig. 4. Note the small holes through which an even gas flow is obtained around the whole joint. The ring-and-tube joint is welded from the inside of the flame tube, and the metal is melted to form a smooth rounded bead on the inside and a uniform filler weld around the outside. Note the number of other joints in this assembly. The combustion chamber is given a hydrostatic test of 100 psi before assembly.

Seam and Spot Welding

A circular seam joining a flange to the outer exhaust cone is shown in Fig. 5. This weld is made by a resistance seam welder, but the longitudinal seams in both the inner and outer exhaust cones are welded by the atomic-hydrogen process. Many parts in the exhaust unit assembly are spot welded where pressure-tight welds are not required. The outer cone is also given a 100-psi hydrostatic test.

There is much arc welding in the nozzle diaphragm, (Fig. 6), and the welding and machining sequence must, therefore, be controlled very closely. The nozzle area has a critical effect on the operation of the unit, so the diaphragm must be scrapped if it is not within the drawing tolerances.

Flash Welding, Too

Shown in Fig. 7 is a shaft of SAE 4140 material flash welded to a wheel forging of special alloy steel. The chrome-moly steel shaft is 3¼ in. in diameter. It is welded in about 2½ minutes; overall time including handling is about ten minutes. Because it is a machine weld, the quality can be pretty well controlled (see Fig. 8).

This joint has given excellent service. Of all the flash-welded joints made on the I-40 turbine wheel, only one resulted in a failure. The single failure occurred during the high-speed test before final assembly.

Aluminum is used in the air intake system, which is fabricated partly by spot welding and partly by use of oxy-hydrogen welding and brazing.

The fuel system is made up of stainless tubing and copper tubing. These joints are silver brazed, which results in an assembly having both a good appearance and pressure tightness.

To summarize, virtually all welding processes — atomic-hydrogen, metal-arc, spot, seam and flash welding, gas welding and silver brazing— have been called upon to produce this newest type of aircraft engine, an engine which has made possible a coast-to-coast flight across the United States in the almost incredible time of 4 hr, 13 min.

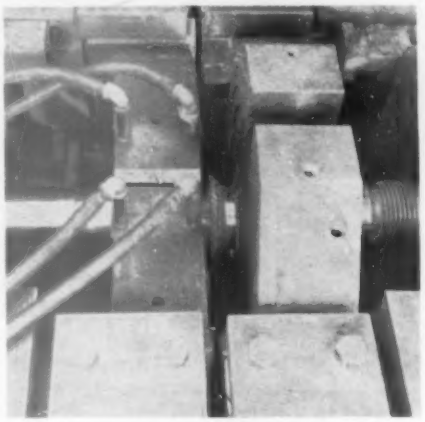


Fig. 7—This shaft of SAE 4140 material has just been flash welded to a wheel forging.

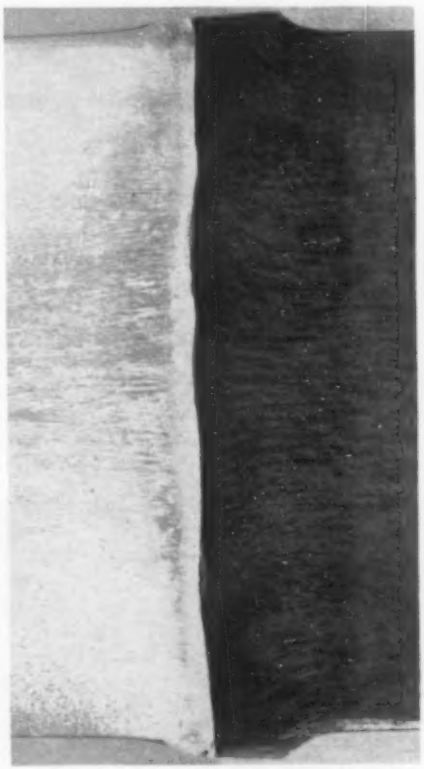


Fig. 8—Macrograph of longitudinal cross-section of the flash-welded wheel and shaft shown in Fig. 7.

Typical scenes at the 1946 Metal Show. The attendance was considerably larger than had been anticipated, and it was sometimes difficult to get through the aisles.

27th National Metal Congress

First Metal Show since October, 1944, reveals that many wartime techniques are adaptable to peacetime products. Over 42,000 visitors inspect eight acres of exhibits.

By **CLYDE B. CLASON**

THE 27th National Metal Congress and Exhibition, held Feb. 4 to 8 in the year 1 of the Atomic Age, proved worthy of such Hollywood adjectives as "colossal," "stupendous" and "terrific." For those who like their information to be more statistical, 450 manufacturers exhibited some $4,500,000 worth of new products and equipment over eight acres of ground in the Cleveland Public Auditorium. The exhibits ranged in size from a 40 by 60 ft all-steel Quonset hut to tiny inspection gauges. The clocked attendance during the five days of the show was 42,562—over 12,000 more than the 30,000 attendance that had been anticipated.

Welding Well Represented

The American Welding Society did not participate officially as in former Metal Shows, and for this reason many important manufacturers of welding equipment took no display space. Nevertheless, there were at least 90 of the 450 exhibitors whose products, manufacturing processes and equipment were of definite interest to the welding industry.

Manufacturers of induction-heating equipment were present in almost full force to demonstrate the advantages of their equipments in brazing and surface-hardening applications. Even the casual visitor could not fail to be impressed with the speed and ease of control with which induction-brazing operations were conducted. Several new names have appeared to supplement the "oldtimers" in this war-born production process, which seems certain to carve out an important place for itself in industry.

Production gas brazing was also represented by displays of the new-type burners and of an indexing fixture which brings the work to the flame, holds it there the proper interval of time and then carries the brazed assembly to an unloading station.

Powdered Metal in Flame

A new kind of torch that permits a composition of powdered or finely divided metal and the suitable flux to be projected through the flame cone onto the work was demonstrated at the booth of the Powder Weld Company, a Brooklyn manufacturer. Fuel gas, oxygen and a processing gas such as nitrogen are used together in this newly developed process, which should have many applications in building up worn surfaces and hard-facing. The torch can also be used for welding and brazing operations in a controlled atmosphere or as a conventional welding and brazing torch.

A demonstration of electronically controlled flame-cutting drew many visitors to the Airco booth. By looking into a mirror placed below the phototube control box, they could see with what fidelity the scanning beam of light followed the outlines of a drawing. At the other end of the arm, four torches cut out metal silhouettes of a female figure—chosen not so much for its voluptuous curves as to demonstrate that intricate outlines are nothing to the electronic-tracing head.

Visitors who attended the Linde booth were shown some remarkable samples of stainless steel and other hard-to-cut alloys that had been accurately and evenly severed by means of a new cutting process. This process makes use of a powdered flux introduced into the oxy-acetylene flame. Unfortunately, no information on it is as yet available for publication.

Supersonic Weld Testing

A new method of non-destructive weld testing that may soon vie with the X-ray, gamma-ray and magnetic-particle methods of inspection was shown by Sperry Products, Inc. This is the "Supersonic Reflectoscope" which, though it uses supersonic vibrations instead of microwaves, is based on the same "shout-and-echo" principle as radar. To operate, a quartz crystal searching unit is applied to a flat surface of the material being tested, after this surface has been covered with a light film of oil to minimize friction and improve sound transmission. The pattern produced on an oscilloscope screen then provides a visual indication of the location of any defects that may be present in the material. The supersonic

A 40 by 60 ft Quonset building was the largest of the 450 exhibits spread over the Cleveland Public Auditorium. The Quonset is offered by the Great Lakes Steel Corp. as an answer to industrial needs for quickly erected, economical buildings.

vibrations are able to penetrate and be reflected back through up to 10 ft of steel.

Most spectacular exhibit of the show was the 40 by 60 foot all-steel arch-rib Quonset building erected to house the Great Lakes Steel Corporation's showing of various products made of N-A-X low-alloy, high-tensile steels. Quonset "packaged" structures are being fabricated in numerous sizes and are readily adaptable to a wide variety of uses. While the usual assembly is by screws and bolts, there have been several installations where welding was done instead. Since portability is not a factor in peacetime building construction, welding would have to compete on a cost basis only with the bolted method of site erection.

Nails Go in the Groove

One of the secrets of the erection simplicity of Quonset buildings is their nailable framing members. The framework is comprised of two pieces of strip steel welded at intervals, back-to-back. The result is a single construction member containing a groove into which nails can be driven. Thus the exterior sheeting and any interior finishing materials can be nailed directly to the metal framework. The framing member's steel jaws exert a holding power greater than wood.

Those whose thoughts turn toward the construction of prefabricated homes should also consider the advantages of stud welding for attaching new insulation materials such as "Fiberglas" to steel walls. At the display of the Nelson Specialty Welding Equipment Corp., round-headed pointed studs were driven with ease through inch-thick insulation and welded to the steel on the opposite side. The large round heads held the insulation material securely in place.

Metal Congress Program

Technical sessions, round table discussions and lecture courses featured the progress of the National Metal Congress sponsored by the American Society for Metals. Of these various sessions, two evening panel discussions were of outstanding importance. These were both held in the music hall of the Public Auditorium.

On Tuesday evening the discussion covered the subject of "super-alloys" for high-temperature service in gas turbines and jet engines. C. T. Evans, Jr., chief metallurgist, Elliott Co., acted as chairman, while the panel members were Howard Cross, Battelle Memorial Institute, Russell Franks, chief metallurgist, Union Carbide and Carbon Research Laboratories, N. L. Mochel, metallurgical engineer, Westinghouse Electric Corp., Gunther Mohling, Allegheny Ludlum Steel Corp., W. L. Badger, metallurgical section, Thomson Laboratory, General Electric Co., and F. S. Badger, metallurgist, Haynes Stellite Co. Full details were given of the compositions of various alloys developed to withstand the terrific heat generated by gas turbines and jet engines, but representatives of the press present were requested not to publish any of this information.

This Atomic Age

The second panel discussion, held on Wednesday, Feb. 6, was devoted to atomic energy and the new science of Nucleonics. Cyril Stanley Smith, director of Metals Institute, University of Chicago, acted as chairman. Panel members were: S. K. Allison, Institute of Nuclear Studies, University of Chicago, Zay Jeffries, vice-president, General Electric Co., A. B. Kinzel, vice-president, Union Carbide and Carbon Research Laboratories, John Chipman, professor of metallurgy, Massachusetts Institute of Technology. Two facts of special interest were brought out by this discussion: one that there is little chance of an uncontrolled chain reaction wiping out the world and (2) that the smallest atomic-power plant possible to build will weigh in the neighborhood of 50 tons.

"I'm much upset by these rumors, and I'm eager to scotch them," said Dr. Allison in response to a question from the floor concerning the possibility of an uncontrolled nitrogen chain reaction. "I do not know of any way to start a chain reaction that will spread beyond the active prepared material."

Newspaper writers, politicians and public figures in general appear to be profoundly pessimistic over the world's ability to survive the Atomic Age, but not Dr. Gerald Wendt, editorial director of *Science Illustrated*. Speaking at the annual dinner of the American Society for Metals, held Thursday evening, Feb. 7, Dr. Wendt was not afraid to strike out boldly against the prevailing tide of atomic blues. He predicted that the world has seen the last of the atomic bomb as a military weapon.

(Please turn to page 41)

W. H. Eisenman, managing director of the National Metal Congress, found that he couldn't say no when Frank Cucksey, diminutive film actor, handed him brazing-furnace literature at the Lindberg Engineering Co. exhibit.

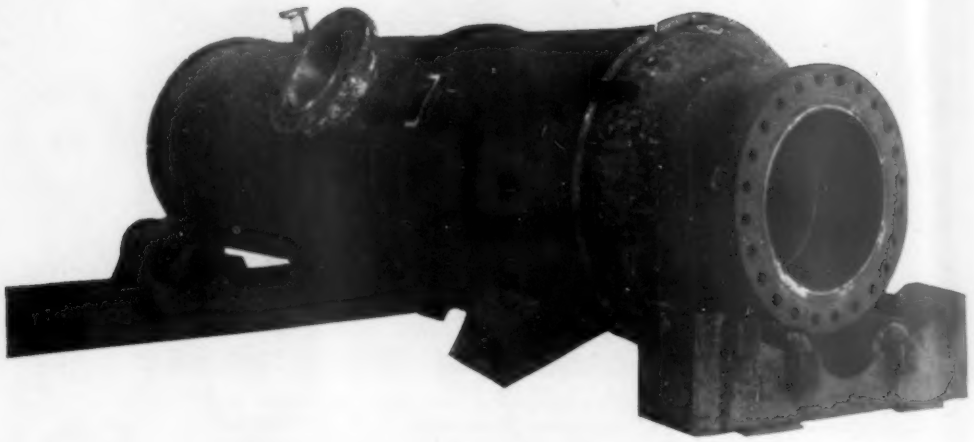


Fig. 1—This vessel was converted to the production of 100-octane gasoline by lining the interior with 1/8-in. nickel sheet.

Nickel-Lined Pressure Vessel

By DONALD E. EVANS and WALTER B. MEYER
John Nooter Boiler Works Co., St. Louis

The problem of finding suitable metals for resisting the attack of chemical reagents, heretofore never encountered in the petro-chemical and other fields, was hastened by the advent of new processes—many of them due to wartime pressures. The tremendous demand for 100-octane gasoline, for example, bringing with it the increased use of hydrofluoric acid, intensified the search for metals and alloys which would meet the new corrosive problems involved.

The accompanying material, which shows the methods used to apply nickel and nickel-alloy linings, is based on data developed by the authors and by the technical service section, development and research division of The International Nickel Co., Inc. The conversion of the steel pressure vessel was done at the Nooter plant.—THE EDITORS.

Fig. 2—Looking into the interior of the vessel. The shell liner has been fitted and tacked, and three segments of the head liner are in position for tacking.

THE economy of using a thin liner of corrosion-resisting material as a layer or barrier to protect a relatively thicker steel vessel has been definitely established. This liner can be attached to the steel vessel by one of two practicable methods currently in widespread use.

Clad Steel, Separate Linings

By the first method, the thin lining is bonded to a steel-base plate over its entire area. Clad-steel plate of this nature may be nickel-clad, Monel-clad, Inconel-clad or stainless-clad. The greatest quantity of this clad steel is fabricated as hot-rolled plate, 3/16 in.

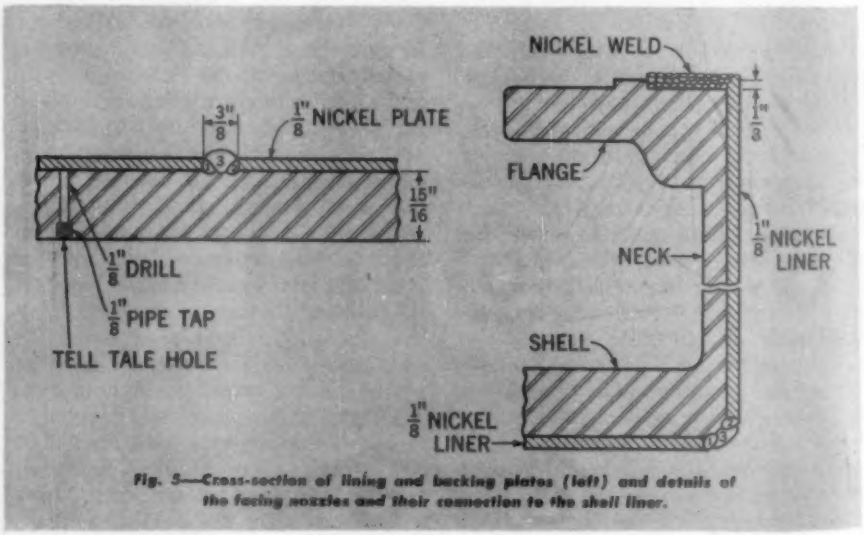


Fig. 3—Cross-section of lining and backing plates (left) and details of the facing nozzles and their connection to the shell liner.

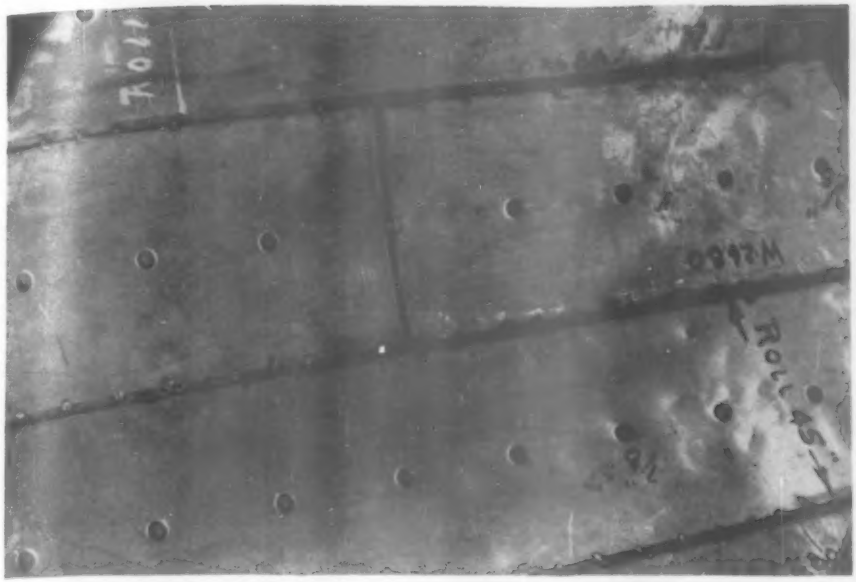


Fig. 3—Detail of the shell liner sheets. The holes for the plug welds were spaced on 6-in. centers midway between the edges.

There are two methods of fitting steel equipment with corrosion-resistant linings: clad steel and a separate lining attached by plug and seam welding. Interesting details of the second method are told in this article.

and thicker. It is used in the building of such large equipment as caustic evaporators and other heavy chemical equipment.

In the second method, the liner is used as a separate and loose lining attached at regular intervals to the steel vessel. These linings of corrosion-resistant metals and alloys can be applied either in the shop or in the field—not only to existing vessels but to new vessels of steel, wood or concrete. This method is illustrated by Figs. 1, 2, 3, 4, and 5.

Heat-Transfer Requirements

The economics and heat transfer requirements of the case will determine whether a new vessel is to be fabricated of clad-steel plate or of steel plate and then lined with corrosion-resistant sheet metal. If heat transfer through the vessel walls is important, the solid, uniformly-clad steel plate will be used to avoid the insulating effect of the slight air space that occurs between the shell and its lining.

For most linings of Monel, nickel and Inconel, sheets are used in sizes as large as can be easily handled in the shop or passed through existing openings in the vessel to be lined. Since the coefficient of expansion of these three materials is about the same as that of steel, full-size sheets may be used for most services, subject, of course, to the limitations noted. Services which involve severe changes of temperature or vacuum will require sheet or strip 18 in. or less in width, unless plug welding is used.

Monel, nickel and Inconel lend themselves to lining work because they can be formed easily to vessel contours, punched for plug welding and readily arc welded to themselves and to the steel vessel.

Linings in Steel Vessels

Arc welding is the only process recommended for the attachment of loose linings to steel equipment. Before such linings are applied, all scale, paint and products of corrosion should be removed from the interior surfaces by sandblasting or steel-grit blasting. If this is not practicable, at least those areas that are welded should be cleaned by spot grinding with a disc grinder. Tanks that have been previously lined with lead or other low-melting materials must have all traces of such materials removed from the surface to be relined for a minimum of three inches from the welding areas. This precaution is necessary because any pick-up of foreign matter at welding temperature may cause embrittlement. In addition, rivet heads should be thoroughly cleaned, even though they are to be protected by sheet-metal saddles or covers.

Although sheet thicknesses for linings are selected to meet the corrosive conditions involved, the minimum thickness, set by practical fabrication considerations, is 0.062 in. Nozzles are usually lined with 0.062-in. or, preferably, 0.072-in. sheet. Nickel and Inconel sheets should be standard cold-rolled grade, and Monel either standard cold-rolled or "35" sheet. Usually all welds are left in the as-welded condition.

Before welding is begun on any lining installation, some experimentation should be made on scrap material, using joints and procedures similar to those indicated for the actual installation.

Nickel-Lined Pressure Vessel

A recent project involved the application of a nickel lining to an existing steel vessel (Fig. 1) measuring 4 ft in outside diameter by 16 ft in overall length. The steel shell was $^{15}/_{16}$ in. thick, and the heads were 2:1 ellipsoidal. The vessel was designed for operation at 450 psi and a temperature of 525 F and was to be converted to the production of 100-octane gasoline.

Before lining, certain alterations were necessary in order to adapt this vessel to its new service requirements. The changes consisted of removing various nozzles and couplings as well

Fig. 4—Close-up of the three head segments shown in Fig. 2, showing the "orange-peel" method of fit-up. Holes for testing the individual segments were drilled in the steel head before the liner plates were fitted.

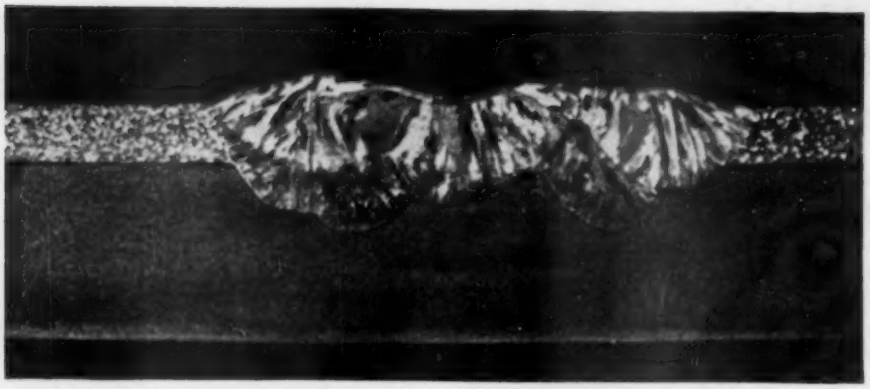


Fig. 6—Cross-section of typical plug weld. The bead was run around the periphery and worked toward the center, all in one pass.

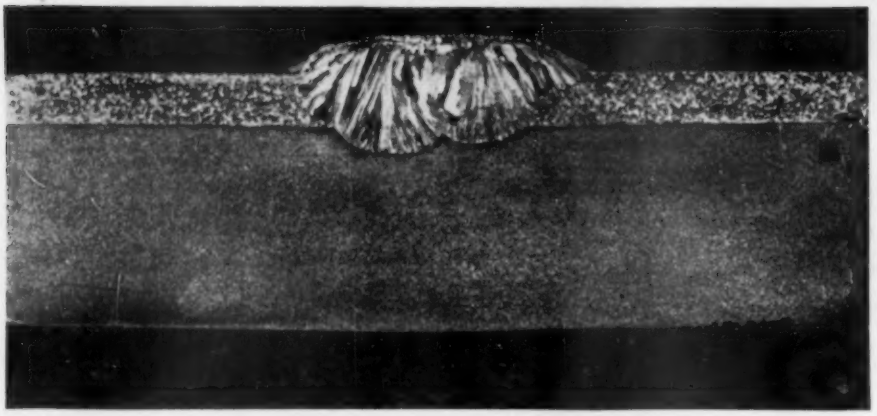


Fig. 7—Cross-section of a typical longitudinal seam on the 1/8-in. nickel liner.

as blanking off the resulting openings. The repaired sections were X-rayed, and the entire vessel was stress-relieved before lining. These changes were made in accordance with API-ASME code.

Welded Joints X-rayed

Since a nickel lining was to be used, nickel welds were required for both plug welding and seam welding. Because of the thickness of the lining—⅛ in. of nickel—it was necessary to make several test plates and X-ray the welded joints before proceeding with the lining job. The test plates consisted of a ⅜-in. mild-steel backing plate to which were attached two pieces of ⅛ in. nickel, 6 by 12 inches.

Test assemblies were made using punched holes for the plug welds. The diameters of these holes were ½, ⅝, ¾ and ⅞ inches. X-rays indicated that holes ⅞ in. in diameter were the most satisfactory for the ⅛-in. lining. The radiographs of the ⅞-in. plug welds indicated solid ⅞-in. plugs, whereas plugs ⅝ in. and smaller showed gas and slag inclusions.

Joints between the nickel sheets were also done experimentally—¾-in., ½-in. and ⅝-in. spacings being used. Finally, care was taken to remove all slag between passes, using a descaling hammer and wire brush for this task.

After the proper procedure was established and verified by X-ray, a test plate consisting of a ⅛-in. nickel sheet 6 by 12 inches welded to a steel backing plate was subjected to a hydrostatic test in excess of 600 psi between the steel and the nickel. No leaks or distortions were in evidence.

Liner Sheets and Heat Segments

The technique for applying the nickel lining having been determined, it was now necessary to prepare the interior of the vessel. All projections, seams and irregularities were ground smooth, and the interior of the tank was sandblasted to get a clean surface and insure a perfect bond.

The nickel liner sheets, measuring 12 in. wide by 8 ft. long, were punched for ⅞-in. plug welds on 6-in. centers midway between the sheet edges and extending the length of the plate. The plates were formed to the inside diameter of the shell and tack welded in place (Figs. 2 and 3).

Head segments were of the "orange peel" type (Fig. 4). These sheets were punched like those which formed the shell liner. After punching, shearing and forming, the head sections were tack welded into place.

Nozzle-Lining Technique

The lining of the nozzle necks and the facing of the flanges required a new and different technique because of their varying sizes. In all cases, the flange faces were recessed by machining them ⅛ inch deep and to a diameter equal to the OD of the raised face of the companion flange.

The neck linings consisted of rolled sheets in the larger nozzles and manway. Smaller nozzle necks were lined with tubing, and the nickel liner for the necks extended approximately 1/16 in. beyond the final finished height of the raised face. The neck liner was welded to the steel flange and the recessed area overlaid with nickel rod to a height sufficient for the flange to be machined to standard finished dimensions. The nozzle liner was attached to the nickel shell in three passes. Details of the lining, facing nozzles and their connection to the shell liner are given in Fig. 5.

All welding was done with 5/32-in. nickel welding electrodes, and each sheet of nickel was welded to the shell as an individual unit. The seams along the edges of the nickel sheets were welded in three passes, following the procedure developed on the test plates.

Fig. 6 shows a cross-section of a plug weld. The bead was run around the periphery and worked toward the center. Fig. 7 is a cross-section of a typical longitudinal seam. In welding the plugs, the arc was struck simultaneously on nickel and steel backing plate.

Welding on this tank required 170 hours and 150 lb of electrodes.

Telltale for Weld Tests

Each panel had a ⅛-in. telltale hole through the steel shell for testing between the shell and nickel liner. This was necessitated by the method used to attach the liner to the shell. After the lining was installed, the entire assembly was subjected to a pneumatic pressure of 10 psi between the lining and the shell. Each section of the nickel sheet was a unit in itself and was tested individually. The interior of the tank was then subjected to a hydrostatic test of 750 psi. In both tests, the telltale holes were a ready means for locating any leaking welds. No leaks were in evidence.

The vessel has been in operation at a pressure of 300 psi for some time, with the telltale holes left open. Every indication points to extremely satisfactory service, with no evidence of leakage.

27th Metal Show

(Continued from Page 37)

Four awards for metallurgical achievements were presented by ASM at the annual banquet, which packed to overflowing the capacious grand ballroom of the Hotel Statler. Gerard Swope, retired president and director of the General Electric Co., was given the Medal for the Advancement of Research. Since Mr. Swope was unable to attend, Dr. Zay Jeffries, G-E vice-president, accepted the medal on his behalf.

The Gold Medal of the ASM was awarded to Earle C. Smith, chief metallurgist of the Republic Steel Corp., for his "outstanding metallurgical knowledge and mature ability in the diagnosis and solution of diversified metallurgical problems."

Robert S. Archer, metallurgical assistant to the vice-president of the Climax Molybdenum Co., New York, received the 1945 Sauveur Achievement Award. He was, said the citation, "responsible for three alloys which may be said to be the base upon which the present-day aluminum forging industry has been built."

The 1945 Henry Marion Howe Medal for technical papers of highest merit went to three scientists: Dara P. Antia, Stewart G. Fletcher and Morris Cohen, all of the department of metallurgy, Massachusetts Institute of Technology.

X-Ray Society Meetings

The fifth annual convention of the American Industrial Radium and X-Ray Society, Inc., was held at the Hotel Hollenden concurrently with the annual ASM convention and the Metal Show. Of the papers presented, three were of especial interest to the welding industry. These were: the second Lester Lecture, "Advances in Steel Weldments in the Past Few Years," given by O. R. Carpenter, Babcock & Wilcox Co.; "Gamma-Ray Examination of Rail Welds in the Moffat Tunnel" by R. Wayne Parcel, and Ray McBrian, Denver and Rio Grande Western Railroad, and "Radiography for Development and Control of Aluminum Alloy Spot Welding" by G. W. Scott, Jr., Armstrong Cork Co.

A symposium sponsored by Committee E-7 of the American Society for Testing Materials in liaison with the Radium and X-Ray Society was held on Friday, Feb. 8, in the grand ballroom of the Hollenden. Professor Lars Thomassen, University of Michigan, acted as general chairman, while co-chairmen were Dr. Herman E. Seeman, Eastman Kodak Co., Dr. John T. Norton, Massachusetts Institute of Technology, Don. M. McCutcheon, Ford Motor Co., and Dr. Leslie W. Ball, Triplett & Barton, Inc.

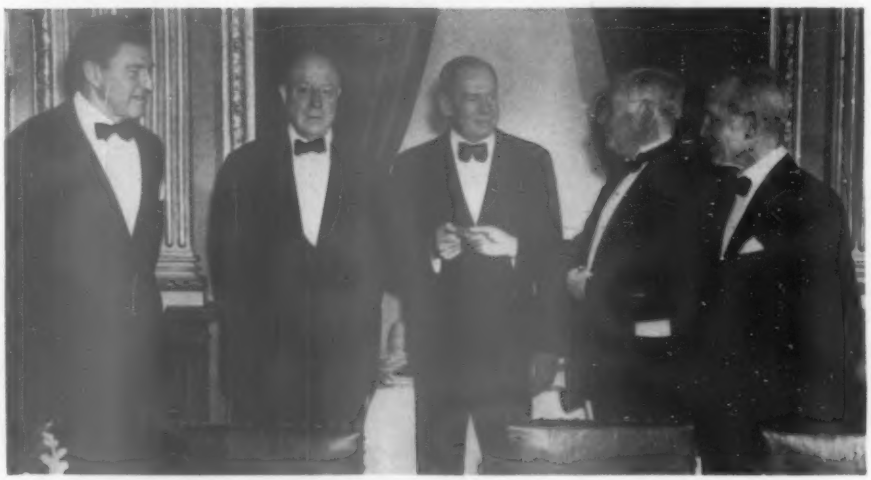
Uses of the Betatron

The morning session of the symposium was devoted exclusively to the betatron, an electron-accelerating device described by one of its originators, Dr. D. W. Kerst, University of Illinois, as being basically a doughnut-shaped X-ray tube. Electrons can be raised to a potential of 20,000,000 volts and directed against a target to produce "hard" X-rays capable of penetrating 15 in. of steel, Dr. Kerst explained. The figure of 20,000,000 volts for X-rays seemed almost unbelievable until Dr. E. E. Charlton, General Electric Company, reported that his company was now working with 100,000,000-volt betatrons but hoped to place on the market a "small" 50,000,000-volt unit before long.

The betatron, it was brought out in the ensuing discussion, has many uses in radiographing very heavy castings but a comparatively limited application for plates less than 6 in. thick. This would automatically exclude it from weld inspection unless a higher contrast film can be developed. It was held such a film would be desirable.

Morehead Medallist—Admiral Vickery

THE 1945 James Turner Morehead medal of the International Acetylene Association was presented to Vice-Admiral Howard LeRoy Vickery for his "eminent leadership in advancing the use of the oxy-acetylene process for the efficient mass production of ships". Admiral Vickery, the twentieth recipient of the Morehead Medal, was awarded this honor at a dinner held at the Metropolitan Club, New York City, on January 28.



Left to right: C. D'W. Gibson, the Honorable John Motley Morehead, Vice-Admiral Howard L. Vickery, G. O. Carter and Vice-Admiral Emory S. Land.

Admiral Vickery served as vice-chairman and commissioner of the United States Maritime Commission until January, 1946. In this capacity, he had much to do with the tremendous shipbuilding program which the Maritime Commission has developed since its formation in 1937.

In his speech of acceptance, Admiral Vickery pointed out that 51,406,000 dead-weight tons of ships were built in the United States between January, 1942, and September, 1945, and built in time to be used when needed. To accomplish this incredible production feat, it was essential to employ every modern method for saving time and materials. Among the most valuable of such methods were the oxy-acetylene processes for the shaping, forming and treating of steel. Admiral Vickery at once recognized the importance of the oxy-acetylene welding and cutting processes and by his inspiring leadership helped the shipbuilders to make efficient, effective use of them in building the greatest merchant marine fleet the world has ever known.

★ MAINTENANCE

Parts Salvaged by Metallizing

★Part Two—In the final installment of this article, Mr. Brooking describes the production steps of bonding, spraying, finish machining and explains the economics of the process for the salvaging of mismachined parts.

By **WALTER J. BROOKING**

Director of Testing and Research,
R. G. LeTourneau, Inc., Peoria, Ill.

The use of metal spraying or metallizing in the Peoria plant of the R. G. LeTourneau organization was begun approximately ten years ago. Shortly after 1940, it was found that metal spraying lent itself very well to the reclamation and salvage of certain types of parts produced in the manufacture of earth-moving equipment. In the first installment of this article (February, WELDING ENGINEER*), Mr. Brooking discussed the various uses found for metallizing, the parts and materials commonly metal sprayed, the different types of wire used and the spraying and auxiliary equipment needed. He also covered the first four of the seven production steps in this process: cleaning, wire set-up, placing the work in alignment, machining to undersize, rough surfacing, metal spraying and machining to specifications. The last three of these steps are treated in the present installment.—* THE EDITORS.

THE electric bonding unit serves very well on narrow bosses such as shown on the cone in Fig. 7 or on boxes through thin walls where it is impossible to cut threads because of the narrow surface to be built up. It is also very effective for providing a rough bonding surface on parts too hard to thread or knurl.

The bonding unit is also quite satisfactory for roughing up bushings or other parts which are to press-fit a bore. Often a bonding of the surface with the electric bonder provides sufficient build-up to insure a satisfactory press-fit without further processing.

Don't Leave Fingerprints!

Considerable discretion on the part of the operator is required in any method of rough surfacing. Such matters as the size of thread, number of threads per inch, type of knurling or the combination of bonding, knurling and/or threading on a particular job must be determined carefully.

Great care is also required at this stage of the salvaging operation to keep the parts clean. The smallest fingerprint or drop of grease will prevent the spray deposit from bonding onto the roughened surface. A fingerprint where the material fails to bond will normally chip out during the machining, and the salvage operation will have to be repeated from the machining undersize stage. This wastes time and increases the costs of salvage.

Should a small quantity of oil or a fingerprint accidentally get on a surface to be metal sprayed, carbon tetrachloride may sometimes be used satisfactorily to clean the part. However, the best insurance against failures resulting from fingerprints, etc., is for the operator to be extremely careful. Furthermore, he should always plan his work so that the spraying operation immediately follows the roughening up process.

Fig. 7—The electric bonder is a very satisfactory roughening and bonding agent on the boss of this friction cone, OD and bore of which are too narrow to thread or knurl satisfactorily.

Step Six: Spraying

The spraying operation itself (Fig. 8) is the next step. This consists of lighting the spraying head, fastening it on the carriage of the lathe (or holding it in the operator's hands) and applying the spray with the proper head adjustment while the lathe is rotating the part.

It may be necessary to stop the process occasionally in order to measure the thickness of the material deposited. An experienced operator on routine salvage operations, however, can usually gauge the length of spraying time quite accurately so that he does not have to interrupt the spraying operation to check the depth of sprayed metal deposited.

It is important that the air, oxygen and fuel gas (in our case propane) be dry for metal spraying. Propane and

Fig. 8 (left)—The part should be sprayed immediately after bonding, threading or knurling. Great care must be exercised not to get fingerprints, oil or grease on the prepared surface.

Fig. 9—With OD and ID of the boss bonded and sprayed, this cone is ready for the final step of machining the built-up surfaces to size.

oxygen are usually dry enough if they are taken from bottles as received from the vendor, but air requires a special scrubbing and drying chamber. A very small amount of moisture in the air blast will prevent the sprayed metal from bonding to the surface of the part.

Last Step: Finish Machining

After spraying, the final step in the salvage operation is the machining of the part back to its specified size and the removal of all excess sprayed-on metal. The boss of a friction cone ready for finish machining is shown in Fig. 9. When the built-up surfaces are machined to size and the excess unbonded metal on the adjoining surfaces is removed, the completely salvaged cone will look like the one in Fig. 6 (page 43, February, WELDING ENGINEER).

The operator should start the removal of metal by cutting toward the shoulders so that the sprayed metal tends to back up the material during the turning, facing or boring operation. This will avoid chipping. The sprayed-on material, it should be noted, is rather brittle and tends to chip off with relative ease. If the turning proceeds from one side out to the outer edge of a boss, for example, a whole corner of the boss may break off as the end of the cut is approached.

One of the reasons for depositing a thickness of 0.050 to 0.060 in. of built-up spray metal is that it is easier to machine and is less likely to chip, spall or flake than thicknesses of from .035 to 0.040 in.

The excess metal applied to areas which were not to be built up usually peels off very easily with the skillful use of a hand scraper or lathe cutting tool.

A careful check of all dimensions should be made before taking the part out of the lathe. If it has been undermachined, it is possible to resalvage it in the lathe by roughing up the sprayed surface, applying more spray and remachining. The time that is required to replace the part in the lathe and line it up for resalvage will be saved if it is possible to detect the mistakes in machining prior to removal of the part from the lathe.

Parts sprayed with hard material

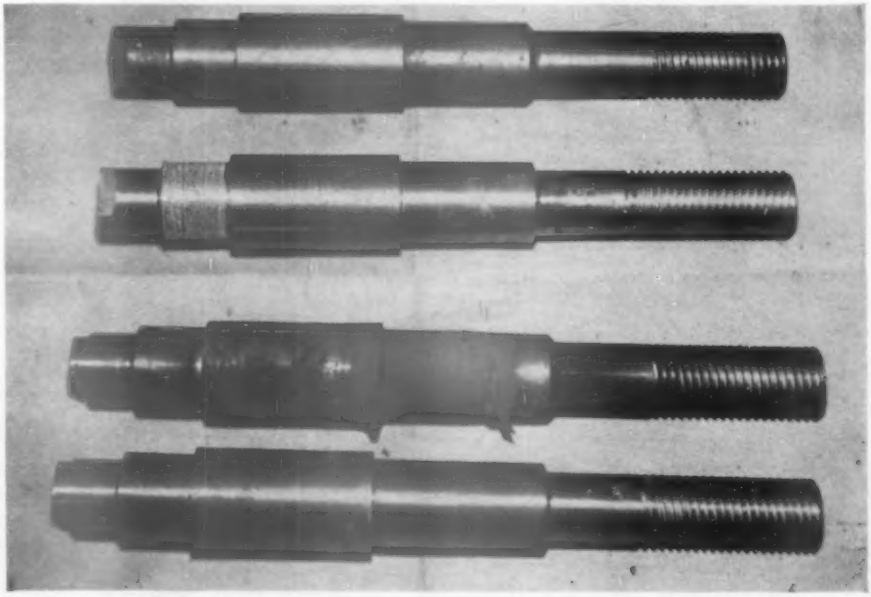


Fig. 10—Four successive steps in the salvage of shafts by building up bearing-cup and oil-seal seats. Top to bottom: The shaft after cleaning; oil-seal and bearing-cup seat turned undersize and knurled; sprayed surface on bearing and oil-seal seat; the finished shaft.

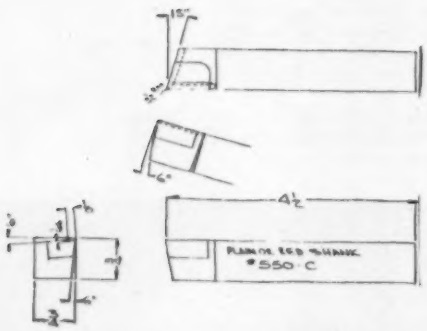


Fig. 11—This tungsten-carbide-tipped turning tool with a carefully ground chip breaker was made standard for undercutting shafts preparatory to metal spraying.

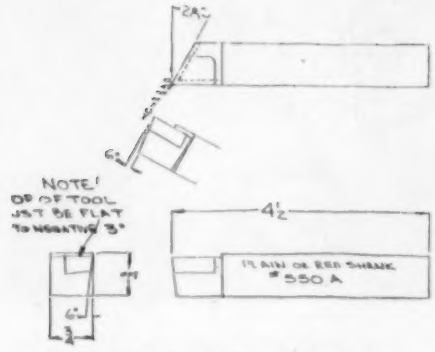


Fig. 12—This special threading tool was used for threading the undercut surfaces of shafts to provide a good bonding surface for the sprayed metal.

—stainless steel, 0.80 to 1.20% C carbon steel, etc.—should be ground in the lathe if possible in order to avoid the extra time required to check and line them up in a grinder if they are not already machined on centers.

Economics of Metal Spraying

The value of the metal-spraying process as a repair and maintenance tool for plant equipment lies, to a great extent, in its relative flexibility and the fact that repairs can be made on expensive or essential parts without waiting for the delivery of new parts and without excessive downtime.

The cost of downtime, lost production time and the cost of a new part must therefore be weighed against the cost of the metal spraying. It will be found that metal spraying very often provides a satisfactory and economical means of getting a machine back in operation.

For salvage of regular production parts, a very careful analysis of the economics of the process should be made, based upon time studies of the individual steps of the process together with a careful study of the cost of workmanship and material in the part up to the stage where the mismachining occurred.

The materials and equipment described in the first installment of this article represent a moderately sizable investment, but one which can pay for itself if other elements of the salvage are not too expensive.

Probably the most important item of all to be studied is the labor involved and especially the labor required to center each individual type of production piece and prepare it for the spraying operation. It is not unusual for parts on which the actual spraying takes no more than five to ten minutes to require 1½ to 2 hours for the whole salvaging operation.

Centerless Parts Difficult

When a comparatively large number of parts of a certain type are to be salvaged, the skillful operator can reduce some of the machining time, adjusting time, etc., by experience and occasionally by fixtures such as mechanical masks to keep the sprayed metal from areas where it is not wanted. In Fig. 9, for example, the boss is the only part being salvaged, and the drilled holes and face tend to require some cleaning time to remove the sprayed-on metal which adheres to them.

Parts which are operated on centers, such as the shafts shown in Fig. 10, are naturally more quickly placed in the lathe and lined up for machining than parts which have no centers, such as the one shown in Fig. 9. It is not unusual, in fact, for the difference between a profitable salvage operation and one which cost more than replacement to be due solely to the time required to chuck and line up for machining a part which does not operate on centers.

As with any other routinized salvaging process, periodic check-ups should be made to re-evaluate the cost of materials and processing labor of metal spraying. Salvaging cost in peacetime should always break even with and should almost always show some saving over the cost of the new part. This rule does not apply, of course, where special factors of material availability must be balanced against the expenditure of additional money to salvage a piece.

In making the calculations, the scrap value of the part should always be deducted from the cost of materials and workmanship. Sometimes the margin of profit from salvaging lies entirely within the range of the scrap value of the part, and if the scrap value were not deducted, the figures should show that it would be cheaper to start over anew.

Economics of Salvaging Shafts

An example of how special tooling and experience provides a profitable margin of salvaging is shown by the procedure worked out for the salvage of the power control unit drum shafts in Fig. 10.

A large number of these shafts are required for regular production schedules, and a small percentage of them are turned undersize on the bearing-cup seat or oil-seal seat. Either of these seats can be built up safely by metal spraying. Each mismachined shaft represents a given amount of workmanship and a moderately sizable amount of steel.

The following steps in the salvage of these shafts by the metallizing process were established:

1. Undercut the surface (bearing-cup and oil-seal seats to be sprayed 1/32 in. on the radius).
2. Rough thread the surface, using 16 threads per inch.
3. Knurl with a shaft knurling tool.
4. Spray the prepared surfaces with 0.25% C wire.

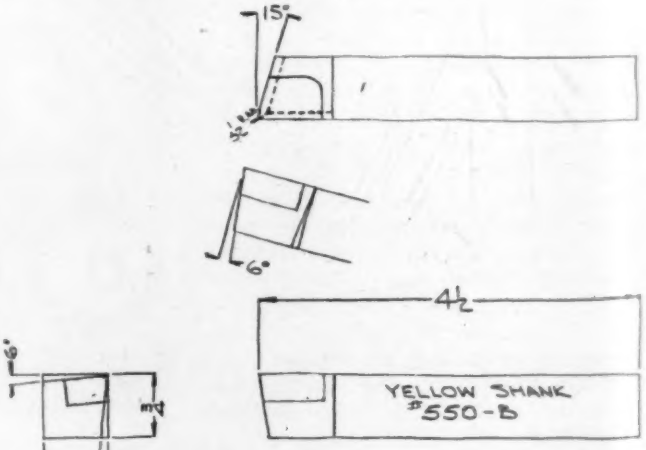
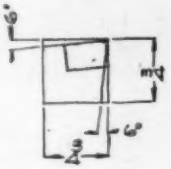


Fig. 13—This special tool was employed to face the first end of the metal-sprayed surface, turn the surface prior to finish grinding, face the other end of the sprayed surface and cut the relief for grinding—all without resetting the tool in the tool holder or stopping the lathe.



5. Trim excess metal from the ends of the sprayed surfaces.

6. Rough turn shaft, leaving 0.020 in. above the finished size for grinding.

7. Finish grind shafts on an external grinder.

8. Inspect all shafts for dimensions. At random check one out of twenty shafts with a severe shock test by hammering the metal-sprayed surface to test the quality of the material.

The fact that these shafts were machined on centers allowed finish grinding on an external grinder to be more efficient than grinding on the lathe where the metal spraying was done.

Develop Special Cutting Tools

Originally, this salvage operation was done with high-speed-steel tools, but after some experimenting and study it was found that the use of tungsten-carbide-tipped tools especially designed for the operation reduced the machining time to less than half that required with high-speed tool-steel tools.

Since the bearing seats and oil-seal seats which had been turned too small were to be built up before the more expensive drilling and threading operations were performed, it was economically possible to salvage mismachined shafts by metal spraying.

The ordinary tungsten-carbide-tipped turning tool sketched in Fig. 11 was standardized for the turning down of the OD of the areas to be metal sprayed. The special threading tool detailed in Fig. 12 provided the necessary type of thread to give the best bonding quality on these shafts.

The turning tool shown in Fig. 13 was especially ground so that it could be used to turn both ends of a bearing and oil seat built up by metal spraying and also to turn the main surface which was built up without changing tools. A 15-degree clearance was used so that the tool could trim the outer ends of the sprayed surface, then be fed forward to machine the main sprayed surface, and be fed into the work to cut the grinding relief—all without having to reset the tool. A clearance of 0.020 in. was left on the turned surfaces for finish grinding. The speed of turning obtainable with the tungsten-carbide tools plus the fact that the grinding relief could be cut with the same tool without rehandling reduced the time of turning to a small fraction of what it was with the original high-speed-steel tools.

Cost Figures on Salvage

A representative study of the salvaging of 14 of these shafts was made. It was found that the following expenditures for work and material were required:

Labor (at $1.00 an hour)	$21.60
Oxygen	1.30
Propane gas	.45
Wire	1.25
Overhead at 100% of the labor	21.60
Total	$46.20
Cost of reclaiming each shaft	$ 3.30

The actual value of the metallizing process in the salvaging of these parts includes the salvage of material plus the labor involved up to the point where the salvaging operation takes place. Much of the expensive machining on the shaft is done after the metal-spraying operation. By reducing the cost of the machining operations to about half of what it was, the tungsten-carbide tool development made the salvaging of these shafts practicable, with a small margin of profit.

Operator Qualifications

The operator of a metal-spraying unit is probably the most important factor in the whole salvage process. The care with which he performs each of the many details of the operation and the judgment which he exercises in the selection of the individual steps of the process determine the success or failure and the economic usefulness of the operation.

Some of the things which a metallizing operator should know are:

How to operate an engine lathe.

How to remove metal.

How to select and use a variety of metal-turning tools.

How to read micrometers, gauges and other measuring devices, examples of which are shown in Fig. 14.

How to read blueprints.

How to set up, adjust and operate a metallizing gun.

How and when to use an electrical bonding unit.

How to use the ordinary tools of mechanics and machinists in careful machining operations.

Some of the qualifications which a metal-spraying operator should have are:

He should be a good mechanic, having a high degree of mechanical aptitude.

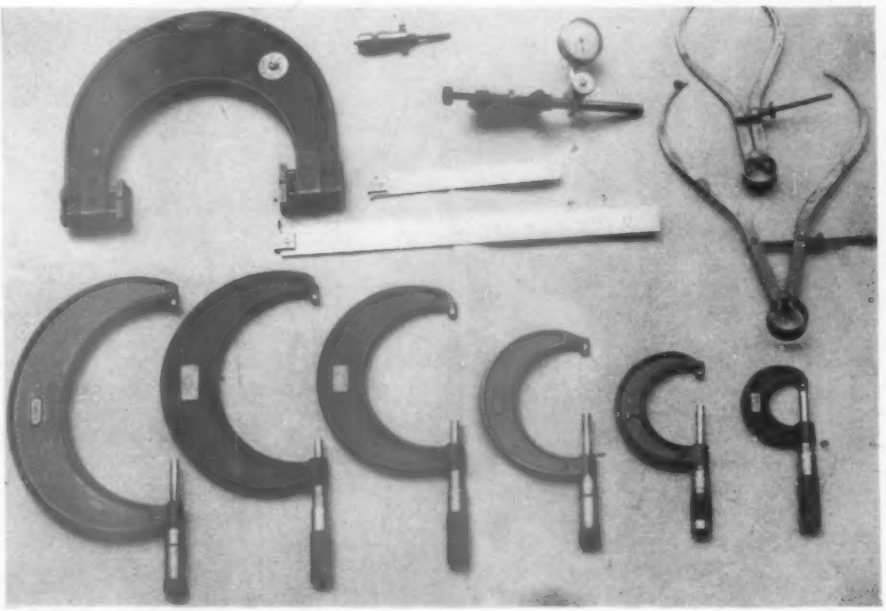
He should be a careful workman, using tools and equipment with precision and discrimination.

He should be a careful workman, one who puts special emphasis on cleanliness and exactness of adjustment of such things as tool settings, tool grinding, metal-spray machine adjustment and inspection measurements.

He should be a good observer and intelligent interpreter of various small details such as water in the air blast, the difference in machining between a carbon-steel deposit of 0.10% C and one of 0.25% C, the difference between a bonded, knurled or threaded surface, etc.

In order to become proficient on a job including such requirements, an abiding interest and curiosity in the process is necessary. Without it, the details can hardly be mastered.

Fig. 14—The metal-spray operator should be able to use precision measuring instruments such as these in his daily work.



★ MAINTENANCE

The welding torch is as important to the pipe fitter as his wrenches.

New Tasks for Welding Torches

Railroads use oxy-acetylene welding torches for many other purposes besides welding—to apply local heat where fitting is difficult, for straightening, shrink fitting and to loosen stubborn nuts and pipe fittings.

By **ARTHUR HAVENS**

WHILE walking through a railroad shop a few weeks ago, I noticed a worker who seemed confronted with an insurmountable problem at the front end of a large Mikado-type locomotive.

He had been assigned to fasten some pieces of ¼-in. boiler steel, (he called them scabs) around the steam pipes in such a manner as to prevent the vacuum in the front end being broken by air leaking in around the large cast-iron pipes. To prefashion anything that would fit this myriad of curves and humps would take hours of valuable time. So naturally I wondered how he would set about to overcome the obstacle.

He Found a Way

The simplicity with which the task was accomplished was another boost for the oxy-acteylene torch as a means to get a good job done quickly.

First, he used his cutting torch to cut out the two plates so that they would fit tight to the steam pipes. These pieces were then placed in position and tack welded to the smoke box wherever they happened to touch it. Next followed a series of heating and hammering operations, each one bringing the scabs into better position so that they could be tacked more securely. In a matter of minutes the plates were all in place and the steam pipes were sealed tight, a definite insurance against air being sucked into the front from this source.

Investigation proves that this method is nothing new; good mechanics have for years realized the value of using the heat of the welding torch to form difficult patches and to lay up flanges on heavy boiler installations.

Fitting a Patch

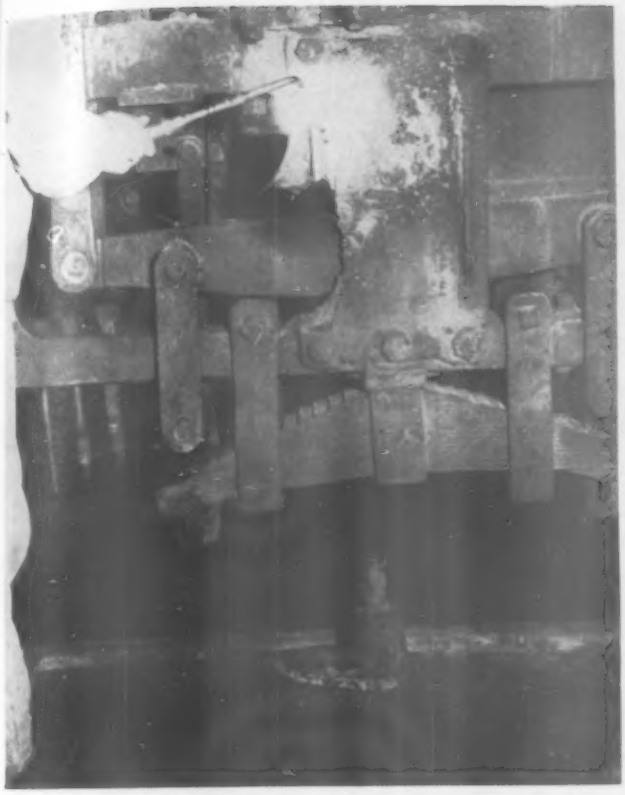
On this same locomotive, the boilermakers were fitting a patch to replace a cracked section of the flue-sheet knuckle. It is a well known fact that, regardless of the care expended in preforming a patch, it is still necessary to finish the fitting of the flange after the patch is in place. For many years this was accomplished by heating the metal with a huge kerosene torch until it became red hot and then driving the flange into place with a sledge hammer and a flatter.

How much simpler the job is now! A large heating head is placed in the welding torch. A section of the flange is heated to a bright red, and then a flatter fitted into a heavy-duty air hammer drives it rapidly into place.

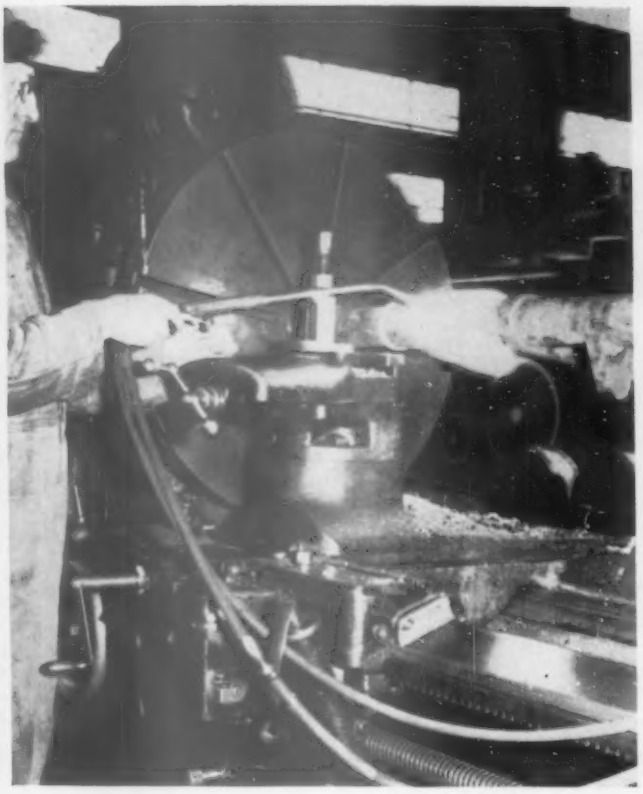
Although most boiler patches are heated in a charcoal fire when they are being formed, railroad shops find it to be of great advantage to have a welding torch hooked up and ready to apply additional heat if and when it is needed at some recalcitrant spot. It takes only a second to light the torch and apply the heat at the spot where it's needed.

Shrink-Fitted Followers

Many railroads apply steel piston followers to piston rods by a combination of press and shrink fit. The ¾-in. tapered fit on the end of the rod is machined until the follower will slide to within ¼-in. from the shoulder on the piston rod. Using one or



Bent and broken locomotive frame castings may be straightened in place with the aid of the welding torch.



A welding torch cannot be topped for the straightening of parts in a lathe.

two torches, the steel follower is heated until it has expanded to the point where it will slip up to the collar of the rod. Then, using plenty of speed, the follower is placed on the rod, and the assembly is rapidly lifted into the wheel press. Here enough pressure is applied to hold the follower tight against the piston-rod collar until the assembly cools. (Water may be used as a cooling agent.) When the assembly is removed from the press, the nut is applied, tightened and then welded solidly in place with a coated electrode. A piston-rod follower applied in this manner has never been known to loosen under ordinary service conditions.

Important to Pipers

The modern welding torch is today as important to the locomotive piper as are his pipe wrenches and chain tongs. Seldom do you see a pipe fitter start for a job without a length of welding hose and a welding torch included in his equipment. Injector feed pipes, discharge pipes, and injector steam pipes are made at the bench and formed as close to shape as possible by heating them and bending them by hand or in an air-operated pipe-bending machine. It is, however, practically impossible to shape all of the intricate bends perfectly. So instead of the tiresome process of repeatedly returning to the bench to change these pipes, the piper heats them in place with his welding torch and fashions them into the desired shape.

Ofttimes pipe unions that have not been loosened for some time will resist the efforts of a man and a pipe wrench to a point where it seems as though no amount of brute strength will ever be able to break the joint. Here the pipe fitter can use his welding torch to a good advantage. Heating almost any stubborn union to cherry red will cause it to come apart easily and without ruining the union. This certainly is an easier, better way to do it than the old-style hammering and so-called "destruction" method.

Loosening Stubborn Nuts

Few are the railroad mechanics who at some time or another have not been confronted with the chore of removing the nut off a set of type-E superheater unit bolts. Rarely can one of these 1⅛-in. nuts be loosened unless it has first been heated with the welding torch. Even though a modern impact wrench with its wondrous persuasive power is used, it is still necessary to warm these superheater nuts before they can be loosened.

Due to the stubbornness of nuts on type-A superheater unit bolts, it had become a custom to cut the bolts off just above the units. Though this was a speedy way to remove the nut, it could hardly be called economical. Believing, however, that the speed offset the increased cost, railroad mechanics advanced no method to prevent the waste of bolts until war conditions forced their hands. With no replacement bolts available, it became imperative to save every bolt removed.

The welding torch solved this problem as easily as it had many others. By heating the nuts to a dull red, they could be removed with the same wrench and bar used in tightening.

Link-Support Casting Repaired

Were it possible to operate locomotives without the occurrence of breakdowns, the railroad shop foreman's life would be a lot happier. Since this is not possible, he must do the next best thing and that is to have suitable equipment and devise methods to repair the breakdowns speedily and efficiently.

In a recent engine failure, the broken main rod struck the link-support casting and bent and broke it beyond recognition. Hurried calls to other railroad shops and locomotive builders revealed that is was impossible to buy, borrow, beg or steal a similar casting. Nevertheless, the engine was vitally needed, and it fell upon the foreman

Bending a reverse shaft arm is not difficult with heat from a welding torch.

Shaping a cumbersome ash pan—another task for the welding torch.

to have the intricate casting straightened and welded—a labor worthy of Hercules!

He began by creating a likeness of the casting's position on the locomotive on an old planer bed. The pieces, such as were left, were bolted into position. By alternate heating and bending, the casting was brought back to shape so that the breaks could be welded and the missing sections replaced. The casting was soon back on the locomotive, thanks to the ability to heat locally with the oxy-acetylene torch. A minimum of valve adjustment was needed, and the locomotive was as square as when built.

Straighten Crosshead Guides

When crosshead guides are being realigned in the back shop, it is not uncommon to find the guide yoke sprung out of position, throwing the guide bars out of lateral alignment with the cylinder bore. The guide yoke can usually be heated with one or two (if it is exceptionally heavy) heating torches and straightened back into position. This method of correcting the fault is much simpler and more effective than the usual stopgap of filling the holes in either the guide or the yoke and redrilling.

As I watch a wheel-press mechanic heat a driving wheel to remove a recalcitrant crank pin, I often wonder what he would do if it were impossible to apply heat with the welding torch. It is not unusual to find that the pressure exerted by the wheel press is insufficient to start a heavy crank pin or driving-wheel axle. Years ago—before we discovered that a few minute applications of heat in the proper spots with the welding torch would help to start these contrary fits—it was necessary to upend the wheels under a drill press and drill a row of large holes across the face of the axle or pin. Even this drastic remedy failed at times to relieve the fit. Now it has become a standard practice to heat these extra-tight fits, and I have never known one to resist the combined efforts of press and heat.

Loose Eccentric Arms

When eccentric arms become loose on the crank pin, it is a simple matter to heat them and place an arbor of the correct diameter in the crank-pin opening. The crank arm is tightened onto the arbor and left until the arm becomes cool. To facilitate removal of the eccentric arm from the arbor, it will be necessary to drive a small steel wedge into the slot in the arm.

The torches used for all of the heating applications I have described and those shown in the pictures are the same ones used for welding. The tip size is controlled by the area or thickness of the part to be heated. Usually a large tip, and sometimes the largest available, is used.

Special Heads Needed

It is reasonable to assume that when welding equipment manufacturers realize the number of heating applications and the amount of oxygen and acetylene consumed for this purpose, they will create special oxy-acetylene heating heads with two or more tips designed for the sole purpose of heating rapidly. In fact, at least one manufacturer has a heating head of this type on the market now.

★ CONSTRUCTION

"Whale" Piers for Mulberry*

By A. LAMONDE, M.B.E., and R. G. BRAITHWAITE, M. Inst. C. E.

Fig. 1—A section of the "Whale" pier at Arromanches.

Two British engineers describe the fabrication of the floating bridges for the "Whale" piers, which played a vitally important part inside the famous Mulberry harbors. The work involved some 350 miles of welding.

THE design and preparation of equipment for the invasion of Europe was the chief problem before the technical branches of the Services in early 1942.

Piers a Mile Long

The necessity for floating piers as much as a mile long, reaching out from the flat beaches into deep water, was expressed in the now famous Minute of Winston Churchill in May, 1942, demanding the solution of the problems involved at all costs. That the problems *were* solved is now common knowledge, and in due course the "Whale" piers played their part inside the famous Mulberry floating harbors.

In July, 1942, the War Office engineers had got far enough ahead with their designs to ask the engineering firm of Braithwaite and Co., Ltd., to build eighteen prototype spans for floating bridges for the "Whale" project.

Since much of the work was experimental, the firm had to work from outline drawings. Its prewar experience in the construction of large multi-span bridges, including those crossing the Ganges, Brahmaputra, Irrawaddy and Nerbudda rivers, was of considerable assistance to the authorities in planning the job.

Preliminary Construction

The bridges required were for linking the landing piers to the shore and consisted of multiple units carried on floats. They were designed to give maximum flexibility under wave action while remaining stable under heavy moving loads. The preliminary task involved the preparation of twelve ordinary spans and six telescopic spans and items of floats, erection tanks, pivot plates, rock insertion floats, shore ramp floats and anchorage equipment. The total weight of steelwork was 880 tons.

When the fabrication was completed, these prototype spans were erected on the sea and severely tested. The testing included subjection to winter gale conditions, with waves running as high as 12 ft. The bridges came triumphantly through this test. The design having proved satisfactory, the authorities decided to place contracts for the mass fabrication of no less than ten miles of bridging, of which four miles, equivalent to 270 spans, were awarded to Braithwaite and Co. Of these 270, 200 spans were made at the firm's West Bromwich works and 70 spans at its Newport works, both branches acting as independent parent firms for their own area.

350 Miles of Welding

The contract involved the fabrication of 9,500 tons of steel, with 350

* Based on an article from the British publication, *Welding*.

miles of welding to be accomplished in a working period of nine months. In addition to this work, the company was responsible for the manufacture of all master and sub-master templates, seven complete sets of the latter having to be sent out to other parent firms to insure interchangeability of components.

Braithwaite's experience gained in specialized jig work for bridges enabled it to bring into play a first-class technique for accurate fabrication of the components. The tolerance allowed between centers or holes in units was plus or minus 0.031 in. and that on the holes themselves was plus 0.010 or minus 0.005 in. It was absolutely necessary for the sake of complete interchangeability that these limits be rigidly adhered to. It should be borne in mind that this was on ordinary black plate with much of the scale remaining.

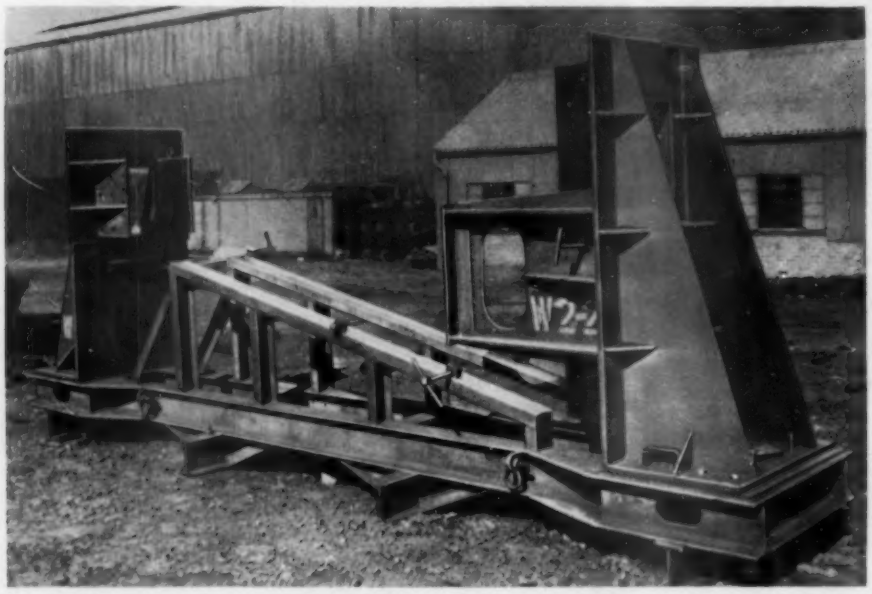


Fig. 2—Assembly jig for welding flange plates and diaphragms.

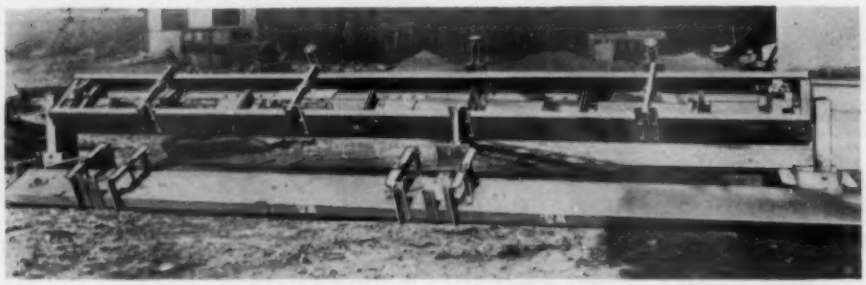


Fig. 3—Jig for welding gussets to flanges.

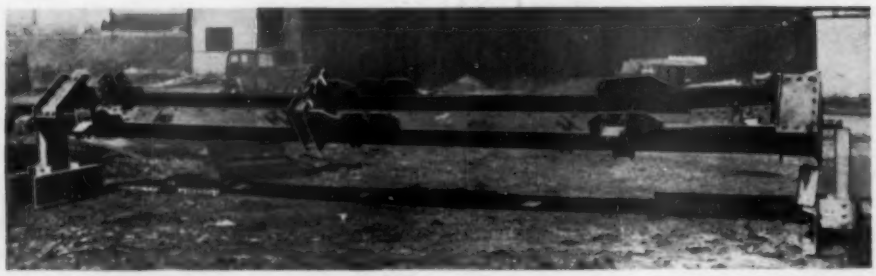


Fig. 4—Drilling jig.

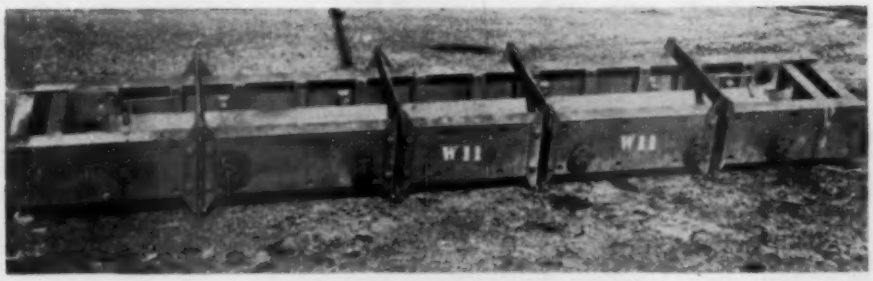


Fig. 5—Welding jig for diagonal web members.

To make certain that all the work from the subcontractors would be identical, Braithwaite and Co. made sub-master templates for them and also for the other companies who were acting as "parent" firms for their own areas. These templates were used by the subcontractors to make their own working templates and drilling jigs. The sub-master plates themselves were kept for reference and checking purposes. The working jigs carried hardened steel bushings to guide the drills. The positions and diameters of these bushings were frequently checked, and they were taken out and replaced as soon as any appreciable trace of wear was noted. The sub-master and master templates alone weighed over 100 tons.

Some forty firms were engaged as subcontractors by West Bromwich alone and another thirty by Newport to assist in producing the components required. Their loyal collaboration materially assisted in completing the work by the scheduled date.

Each bridge consisted of two "hog-back" girders carrying a flexible floor and supported at the ends on special bearings. The general arrangement of the piers is shown in Fig. 1, a picture taken at Arromanches shortly after D Day. It will be noted that additional flange plates have been riveted onto the chords. This was a later modification due to the heavier loading requirements and these were known as Mark II spans. This article, however, is confined to Mark I spans, on which the additional flanges were omitted.

Flexible Construction

Flexibility is one of the major features of these bridges. Each girder consists of two box ends and bearing linking up the various components. Shop-welded parts with site-bolted connections allowed a minimum of weight coupled with simplicity of site erection. Parts of the bridge were designed as riveted components in order to balance out production in various structural engineering shops. This is particularly in evidence in the case of

the girder verticals and center cross girders.

The fabrication of the box ends was carried out as follows: The side plates were first drilled, using one of the drilling jigs prepared from the submaster templates. All site-connection holes were drilled full size, and profiles for gas cutting were outlined by small holes (½ in.) at intersection lines of cuts. The plates were flame-cut to profile and then pressed at the ends to the required profile to take the end bearing.

Details of Welding Jigs

Top and bottom flange plates were similarly treated, and the internal diaphragms were planed to the correct width. When all the parts had been completed, they were put together in the assembly jig shown in Fig. 2. This jig was one of several made by John Thompson, Ltd., of Dudley, for this purpose; holes drilled at each end accurately located the exact position of the web relative to the flanges and other connections. When the bottom and one side had been assembled, the diaphragms were inserted and the other side plate added. These were tacked together, and temporary spacers were inserted inside the box. The unit, without the top flange, was then mounted in a rotary welding jig, where all internal welds were completed and the top flange plate fitted and welded into position.

After this operation, the box was removed from the welding jig and placed on an assembly stallage for the fitting and welding of the end bearings, the location of which was governed by a special template.

The chord angles were first cut roughly to length, and the ends were bent to the required angle in the smiths' shop. The gussets were then welded to the flanges in the lower jig (shown in Fig. 3). After this, they were transferred to the main welding jig, where they were welded into pairs. They were then transferred to the drilling jig (Fig. 4), after which the ends were machined square and dead to length ± 0.010 in. from the drilled holes.

Adding Web Members

The diagonal web members were built up of welded H-sections in the welding jig shown in Figs. 5 and 6. The web plates were located and clamped by the diagonally mounted center angles, and the flanges were compressed to the web by the screwed clamps at the side. It had originally been intended to preset the flanges to correct welding distortion by hold-

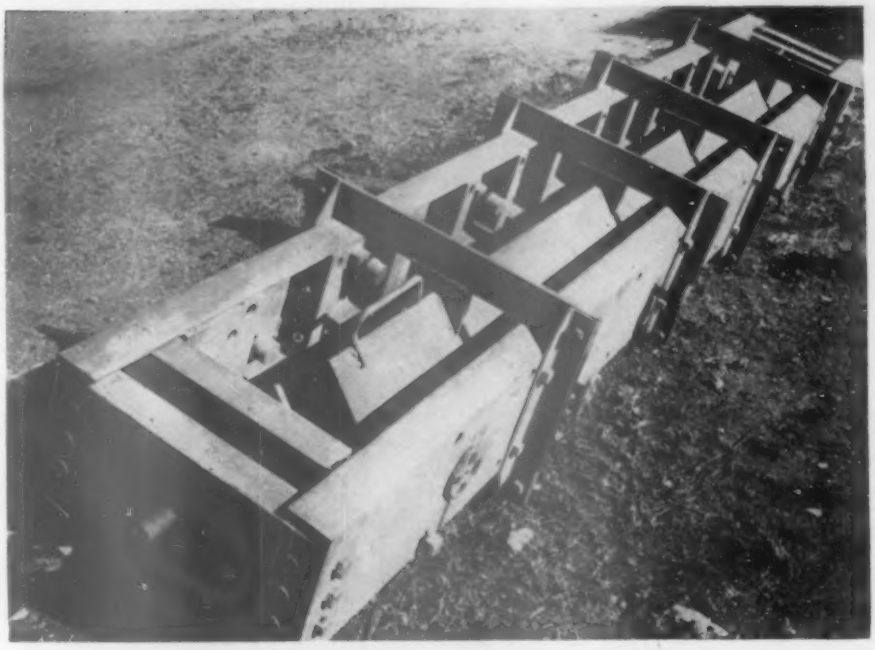


Fig. 6—Another view of jig for diagonal web members.

Fig. 7—Demonstration of the flexibility of the bridge.

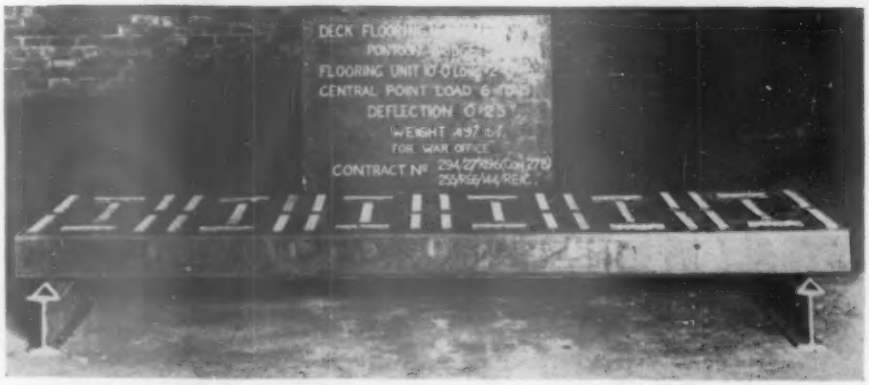


Fig. 8—Special unit for the decking. Note skid bars welded on to give a skidproof surface.

ing the edges down by a strongback, holes for securing which can be seen along the edge of the jig. However, this method was not required, as the rolling mills evolved a method of cambering the components so that when welded they came out perfectly flat across the face and presented a flat surface for bolting into the chord units. This saved considerable assembly time and labor.

The vertical units which carried the gusset for the end pins of the cross girders were made up of angles riveted back to back and called for no special work other than the provision of a drilling jig to insure accurate holes.

The center girder, which was of riveted construction, did not present any manufacturing difficulties. Its design, however, must have created a major problem, as it had to be arranged to keep the top flange fixed to carry the decking while the bottom flange flexed to allow for the wave action on the pontoons. It was connected to the other girders by heavy welded brackets, which gave it full restraint at the ends.

The intermediate cross girders were of joist section with special end bearing plates cut into the web and welded in. The bearing was taken up by a special device in the verticals to secure flexibility. The resultant flexibility of the bridge can be clearly seen from the view in Fig. 7.

Skidproofed Decking

Before they could be ordered in bulk, special units for the decking were made up and tried out under test load. Fig. 8 indicates the final design. It will be noted that the deck is covered with a number of ½-in. bars, which were welded on to provide a skidproof surface the tank treads could grip when crossing the bridge under rough conditions. The center deck panel was made up of channel sections with wooden slats to provide a smoother walkway. The welding of the skid bars to the deck was completed after the deck units had been fabricated from pressings. The amount of welding involved was sufficient to create considerable buckling; this was cured by fastening the sections together in pairs so that the ends met, when a ⅜-in. packing was inserted at the middle. This had the effect of putting in a reverse "bow" to the deck to counteract the deflection of the unit due to welding.

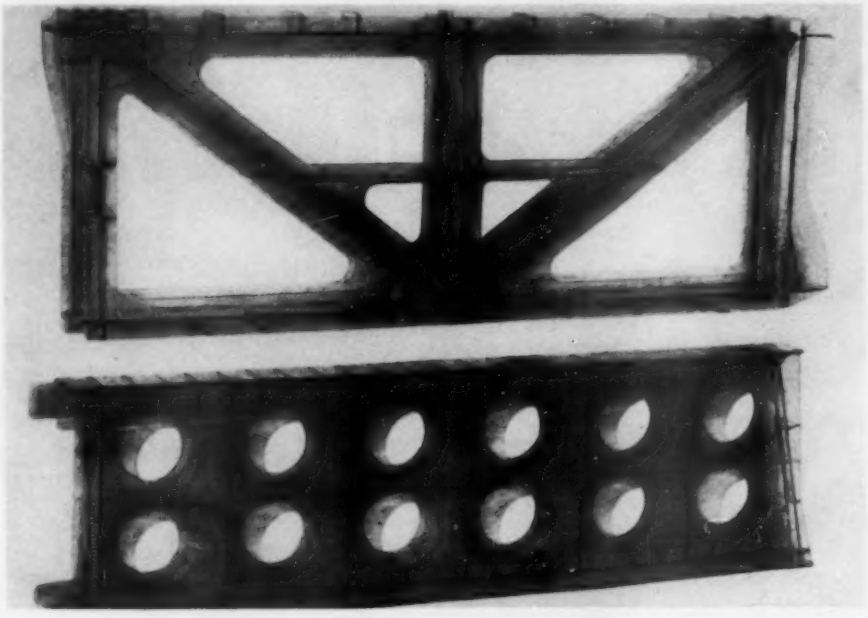


Fig. 9—Celluloid models of the box assemblies.

Use Celluloid Models

The telescopic section presented special problems. Warping had to be carefully avoided if the box section, which was completely fabricated, was to slide readily in the housing. Sufficient tolerance between the outer and inner sliding boxes was allowed for these to be welded up without machining, but special tolerances regarding overall dimensions were enforced. A complete manufacturing program regulating the preparation, assembly and welding of the units insured that these would come out within the tolerances laid down, and no trouble was experienced with their correct functioning *in situ*.

To assist in this work, celluloid models of the two boxes were made, and these gave a literally clear view of the somewhat intricate construction of these assemblies (Fig. 9). It is of considerable interest to note that the inner box is practically impossible to make by any other means than welding, unless a steel casting is employed.

The bridges were held in their allotted positions by special anchors. These kite anchor units are an essential feature of the successful functioning of the scheme and the problem involved is of a special nature. Major A. H. Becket carried out extensive tests in Braithwaite and Co.'s works before the problem was finally resolved. In the course of these tests the designers were assisted by the company's staff.

The final design consists of a cast-steel anchor plate to which mild-steel wing plates were welded. The mooring system was attached to the anchor by means of a swivel arm built up of welded box construction.

General Shop Procedure

A few notes on the general procedure at the works may be of interest. On receipt of an order, the operational plans are prepared in full detail by the drawing office, which passes on to the order office the specification for the material required. This is then ordered to the number associated with the job. When the steel arrives, cut to within an inch or two of the final length, it is already marked with this number and so cannot be used in error on another job. The material is trimmed, mitred or sheared as necessary, and mating edges are planned to fit exactly. Next, shapes are flame-cut. High-pressure liquid oxygen is reduced to normal pressure in the works and piped all over the plant for cutting. Holes are then drilled as described earlier to an accuracy of frequently less than ± 0.010 in. between centers. All welding is arc, and the fullest use is made of positioners so that downhand welding may be employed. A considerable amount of female and unskilled labor is employed.

Owing to the skillful design and the extensive use of welding, the weight of the components of the bridge structures proved to be surprisingly low. The weight of a standard span, for instance, is only just over 31 tons and that of the telescopic spans nearly 35 tons. This is only a fraction of the weight of a bridge of conventional design. The fact that "Whale" piers have stood up to winter gale conditions and heavy use on active service shows that strength has not had to be sacrificed to lightness.

★ MAINTENANCE

Fig. 1—Brazing a tungsten-alloy tool tip on a 1½ by 1½ in. steel shank by use of high-frequency induction heat. Two coils of different size are connected in series. Brazing tips to single-point tool shanks is done in thirty seconds or less with a standard 10-kw, 450-kc r-f generator. The joining is done on a production basis since it is unnecessary to sort shanks into their different sizes.

Tool Tips Induction Brazed

Silver brazing plus induction heating speeds up the job of replacing worn tungsten cutting tips on steel shanks. A tip 1½ by 1½ in. can be brazed in 30 seconds.

By **T. A. VERNOR and E. F. ADAMS**
Westinghouse Electric Corp., Houston, Tex.

THE Reed Roller Bit Co., Houston, Tex., has found a way to silver braze tungsten-alloy tips onto single-point tools in a fraction of the time that was formerly required with oxy-acetylene torches. Tips can now be brazed on a 1½ by 1½ in. tool, the largest used, in about thirty seconds by using induction heating.

A great number of tools are required at this plant since the stock hardness of its product is approximately 350 Brinell, and cutting tools quickly break or dull from wear. Not only is the brazing job speeded up by induction heating, but the life of the tool is improved since the tungsten tip does not reach the same temperature as the mild-steel shank. This is because the power input to a magnetic material is many times greater than to a non-magnetic material with the same flux density. In fact, most of the heat put into the tungsten tip is by conduction from the shank through the silver solder.

Temperature Brought to 1,400 F

As only about an inch of the tool is in the coil (see Fig. 1), all of the power is concentrated in a small volume in a very short time. This brings the temperature at one end of the shank to about 1,400 F in thirty seconds and leaves the other end cool enough to handle with bare hands.

The work coil for this job was designed to handle several sizes of tools without adjusting the r-f generator or changing the work coils. This was accomplished by designing two coils and connecting them in series. One coil consists of six turns of ⅛-in. copper tubing bent in the form of a square 2 by 2 in. The other coil, also of six turns, is 1½ x 2 in. on the inside oblong. With both of these coils connected to the generator in series, it was found that all sizes of tools could be heated. The operator can handle several sizes of tools without first sorting them by sizes.

A tuned plate-coupled grid oscillator circuit is used in the generator. One side of the work coil is grounded for safety. This is possible since most of the voltage is across the tank coil.

Time-Heat Control

The r-f generator used is a standard 10-kw, 450-kc set. The power supply is 440 volts, three phase, 60 cycles. Control is ordinarily by means of a "start-stop" button mounted on the face of the cabinet, but additional remote control stations can be provided where required. On production work where a definite time-heat cycle can be predetermined, the automatic timer can be used to de-energize the unit after a predetermined time.

The generator is protected by magnetic overcurrent relays in the plate circuit of the rectifier and the grid circuit of the oscillator tube. The main-line circuit breaker has thermal and instantaneous magnetic overload protection, and the control circuits are fused. The grid-controlled, three-phase rectifier in this unit provides a flexible means for power output control to the work.

After installation and tune up, an inexperienced operator soon became very proficient in the use of this generator, both for brazing on new tips and for removing those dulled by wear. As a result, the plant experienced no tool shortage, and one potential production bottleneck was broken.

Advances

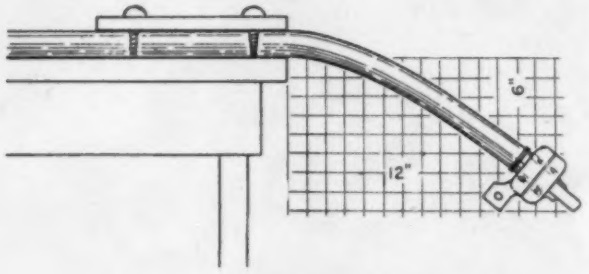


Fig. 1—Bending test. The deflection from horizontal is measured as the cable end hangs free. For comparison between cables, terminals must be the same.

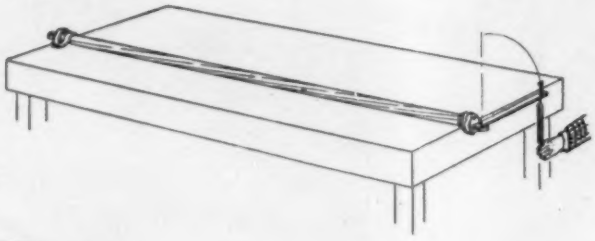


Fig. 2—Twist test. The force is applied one foot from the axis of the cable, and the latter is twisted 90 deg.

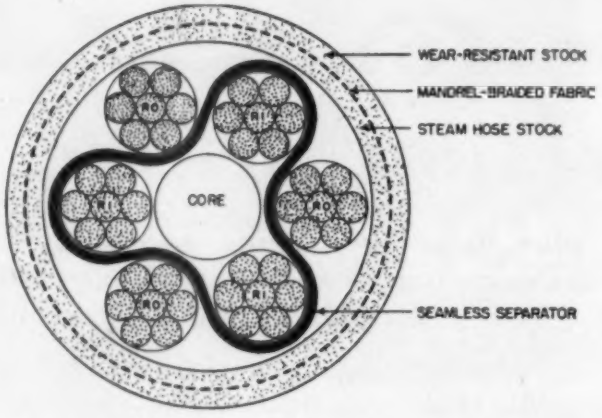


Fig. 3—Cross-section of interleaved type of kickless resistance-welding cable.

THE technical details by which the interleaved type of low-reactance water-cooled resistance-welding cable has been brought from a prewar semi-experimental accessory up to the present stage of commercial product should be of interest to the welding industry. Some of the test methods by which various features were compared and improved may also be useful to engineers in selecting cables for particular applications.

This paper will discuss changes that affect cable flexibility, weight, life, rating and other characteristics of the interleaved type of low-reactance gun-welder cable.

Table I. Flexibility of Light-Duty (267 Mcm) Interleaved Cable, 30-Psi Water Pressure, 6-Ft Inlet Hose ¼-In. ID

	Prewar	Early War	1945
Bending (Inches deflection in 1-ft overhang):			
Type 2-21 terminals (2.5 lb)			
No water	3.8	3.5	7.5
Normal water flow	—	—	7.2
Cable outlet plugged	—	—	6.3
Twisting (Degrees twist per foot-pound of twisting force):			
6-Ft cable:			
No water	33	—	53
Normal water flow	31	—	45
Cable outlet plugged	15	—	22
8-Ft cable:			
No water	45*	40*	65
Normal water flow	36*	30*	43
Cable outlet plugged	15*	24*	25

*Average of clockwise and counterclockwise values. On these cables, there was usually about 50% more flexibility in one direction than in the other. In modern cables, clockwise and counterclockwise values are practically the same.

Improved Flexibility

Ease of bending and twisting is of prime importance to the welding operator. It may be measured by means of an "overhang" test (Fig. 1) and a twisting test (Fig. 2). Table I gives values for some key designs. In all cases, higher numbers mean greater flexibility.

The main improvement in flexibility is credited to a better outer covering. The present three-layer hose has a steam-hose stock inside, wear-resistant stock outside and a fabric reinforcement that is braided on the inner hose while still on the mandrel. The reinforcement is the key to the flexibility of the hose: it is essential that the threads be of the right size and braided around the inner layer of hose with the correct pitch, separation and tension. The greater strength of reinforcement allows a thinner section of rubber to be used, and this also adds to the flexibility.

Use of larger water-outlet openings has also contributed to increased flexibility because of the lower water pressure in the hose. This is not a major factor, however, with the type of hose now being used in kickless cable.

In early cables, flexibility decreased radically with age as the rubber separator and core "grew" under the influence of hot water. Since one essential to the flexibility of interleaved cable is the ability of each conductor rope to move fairly independently in its own compartment (Fig. 3), the tight packing that resulted from swollen rubber ruined the flexibility after usage. This has been remedied by selection of stable synthetic separator and core material, and the cable now remains flexible throughout its life.

With these points added to the natural flexibility of the spiralled, interleaved cable, the current design has been accepted by some users as being more flexible than the two ordinary cables they have replaced.

Weight has been lowered slightly by use of the better hose since thinner

in Water-Cooled Cable*

Wartime gun-welder jobs made such severe demands on low-reactance water-cooled resistance-welding cable that the pace of improvements was rapid. Advantages of the newest type of "kickless" cable are told here.

By **MYRON ZUCKER**
Mackworth G. Rees, Inc.,
Detroit

walls are now used. In early years of the war, heavy-duty hose weighed 0.9 lb per foot; it now weighs 0.67 lb per foot.

Prewar cable life was so short and rating so uncertain that on heavy jobs it was necessary to use cables of generous size. Now, with proved application charts available, it is sometimes possible to decrease weight—and incidentally increase flexibility—by selecting a smaller size of cable. This must not be overdone, however, since it is at the sacrifice of both life and electrical efficiency.

For example, suppose we want the lightest possible 8-ft cable for a gun that welds two sheets of 14-gauge clean low-carbon steel sheet at a steady rate of 30 spots per minute. Is a light-duty (267 Mcm) cable adequate? Facts upon which to base a decision are the current and time to be used in making the weld. For this example, we will use Table II (a condensation of the AWS tentative standards for spot welding low-carbon steel). For 14 gauge, a current of 14,000 amp applied for 17 cycles is recommended.

First consider the selection of cable size from the viewpoint of heating. The duty-cycle factor corresponding to 17 cycles "on" time, 30 spots per minute continuously, is (17 x 30) /3,600=0.142. (The figure 3,600 appears here because it is the number of cycles per minute in 60-cycle current.) Compare this required duty factor of 0.142 with the permissible factor of 0.18 obtained from Fig. 4 for a light-duty cable 8 ft long carrying 14,000 amp.

In this case, the light-duty cable, if properly supplied with water, will not overheat. Advantage may be taken of its lightness and flexibility even on this apparently heavy job.

This example may involve an increase in transformer size. As Fig. 4 shows, an 8-ft light-duty cable takes 10 volts and the heavy-duty cable only 6.5 volts to pass 14,000 amp. Assuming that the transformer secondary voltage equals cable volts plus 5 volts to send 14,000 amp through weld, tool and transformer, we see that a transformer secondary of 11.5 volts would be sufficient if heavy-duty cable were used, whereas 15 volts will be needed to produce 14,000 amp if the light-duty cable is installed.

If lightness and flexibility are paramount and ample transformer capacity is on hand, it is perfectly "legal" to use the lighter cable.

Trend to Longer Life

No representative figures can as yet be given for cable life. A few examples (Table III) indicate the improvement with respect to ordinary cables and early-war interleaved cables. In Table III, cable life is measured according to cable-months per cable failure: that is, if 50 guns are operating for six months and there are 30 cable failures during that time, cable life is 50 x 6/30 = 10 months. This method of stating cable life is crude since it does not account—among other things—for the number of shifts worked per day, the severity of the job as determined by current and rate of welding, degree of bending or cooling conditions. It is, however, as accurate as the method of recording justifies, and if comparisons are made of cable on the same job, the figure does fulfill its purpose of showing the advance in cable life over a period of time.

Perhaps the greatest factor in

* Abstract of a paper prepared in conjunction with the twenty-sixth annual meeting of AWS.

Table II. Current and Time for Spot Welds*

Thickness of Thinnest Outside Piece		Weld Time, Single Impulse (60 per Sec)	Approx. Current, Amp
In.	Gauge		
0.010	32	4	4,000
0.020	26	6	6,500
0.030	22	8	8,000
0.040	20	10	9,500
0.050	18	12	10,500
0.060	16	14	12,000
0.080	14	17	14,000
0.094	13	20	15,500
0.109	12	23	17,500
0.125	11	26	19,000

*Excerpt from Tentative AWS Emergency Standard for Spot Welding Low-Carbon Steel. Published as Table 8 on Page 314-s of "Mechanical Characteristics of Resistance Welds in Plain-Carbon Steel" by W. Sparagen and M. A. Cordovi, THE WELDING JOURNAL, July 1944.

Table III. Cable Life in Months per Cable Failure

Job	Life Ratio*	Principal Cause of Failure	
		Early War	Present
Steel truck frame	6†	Shredding copper	Separator
Assembly of military vehicles	2.8	Overheating inner wires	Operator's neglect to turn on water
Railroad car panels	10.0	Failure at terminals	Separator
Reinforcing bus frames	3.5	Overheating inner wires; breakdown cemented separator	Wear on outer hose
Light military vehicle bodies	10.7	Overheating inner wires; breakdown cemented separator	Wear on outer hose
Farm equipment	3.0	Choking from swelling	Separator

* Ratio of present life to life of cable on same job in early years of war.
† Compared with ordinary single cables.

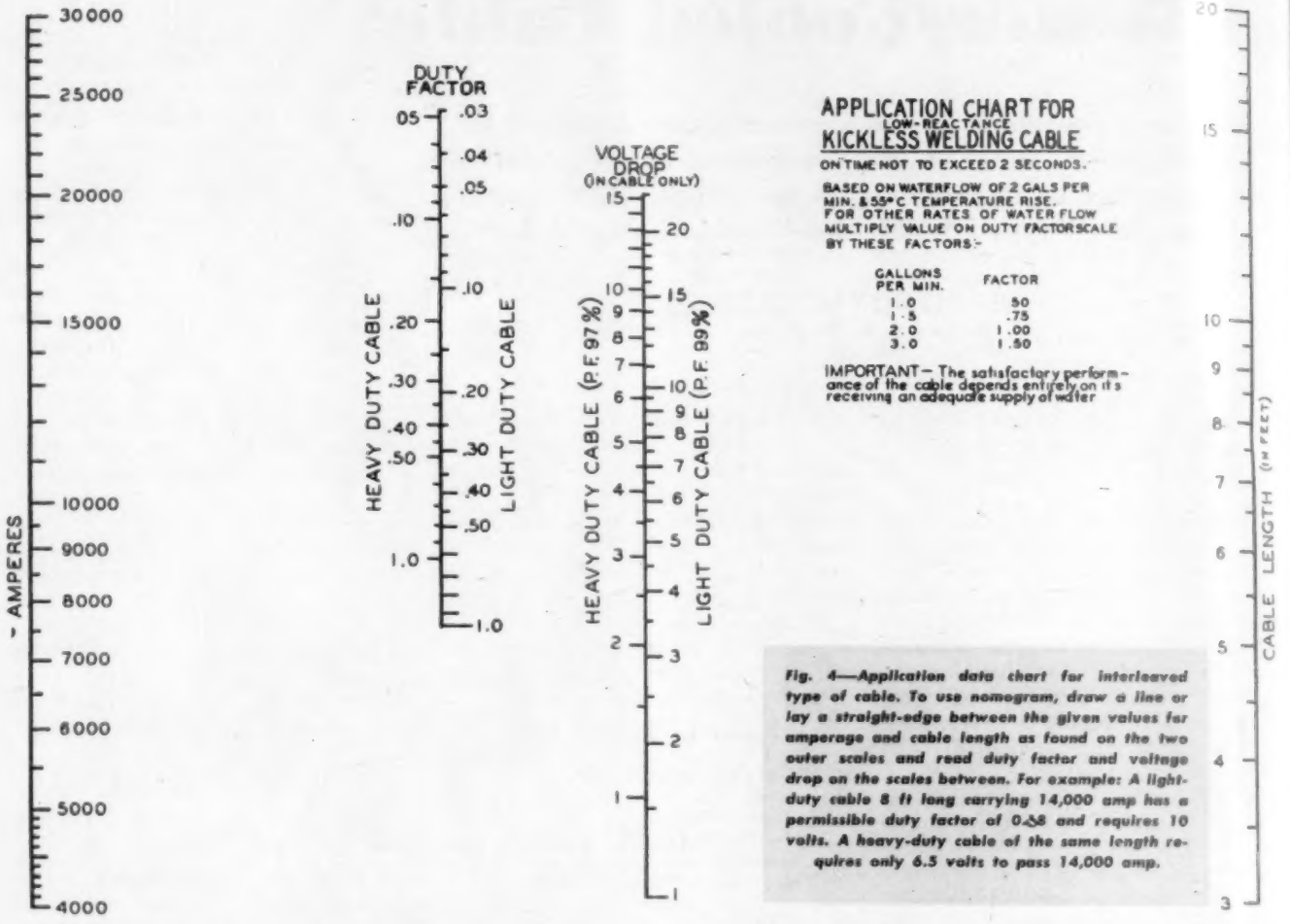

APPLICATION CHART FOR
LOW-REACTANCE
KICKLESS WELDING CABLE
ON TIME NOT TO EXCEED 2 SECONDS.
BASED ON WATERFLOW OF 2 GALS PER MIN. & 55°C TEMPERATURE RISE.
FOR OTHER RATES OF WATER FLOW MULTIPLY VALUE ON DUTY FACTOR SCALE BY THESE FACTORS:-
GALLONS PER MIN. FACTOR
1.0 50
1.5 .75
2.0 1.00
3.0 1.50
IMPORTANT— The satisfactory performance of the cable depends entirely on its receiving an adequate supply of water
AMPERES
DUTY FACTOR
HEAVY DUTY CABLE
LIGHT DUTY CABLE
VOLTAGE DROP (ON CABLE ONLY)
HEAVY DUTY CABLE (P.F. 97%)
LIGHT DUTY CABLE (P.F. 89%)
CABLE LENGTH (IN FEET)

Fig. 4—Application data chart for interleaved type of cable. To use nomogram, draw a line or lay a straight-edge between the given values for amperage and cable length as found on the two outer scales and read duty factor and voltage drop on the scales between. For example: A light-duty cable 8 ft long carrying 14,000 amp has a permissible duty factor of 0.58 and requires 10 volts. A heavy-duty cable of the same length requires only 6.5 volts to pass 14,000 amp.

lengthening the life of kickless cable is the choice of seamless neoprene tubing instead of the cemented separator formerly used. Before this, a large percentage of failures were at the edge of the cemented overlap; removal of this weak point has effected noticeable increase in cable life.

Employment of non-swelling synthetic separator and core has also improved life. The swelling of old cables previously discussed frequently got so bad that water circulation was practically stopped, and the cable burned out. This has not occurred since synthetics have been adopted: an example of where synthetics are better than natural products.

Increased Water Flow

Another important point is increased water flow obtained by a redesign of water inlet and outlet. About 80% of the water pressure is absorbed at these points rather than in the length of the cable. Smoothing and slightly enlarging the paths results in greater water flow. (This is easily measured by seeing how long it takes the outlet water to fill a 3-gal pail or a quart bottle to which it is diverted.) The hose fittings are furnished as standard parts of the cable, and users are advised to check the rate of water flow periodically to make sure they are running adequate water. This is a vital factor in maximum cable life and economy.

Cable Hanging Important

Many users of kickless cables have added still more to cable life by increasing the size of water-hose on their own initiative from the usual ¼ to ⅜ in. ID. At the same time, they are careful to install large fittings so as not to restrict water. Although ratings are based on 2 gpm, it is not uncommon to find 5 gpm pouring through a light-duty cable in operation.

One practical detail that has radically increased cable life in some cases is a better understanding of methods of hanging the cable. To hang low-reactance cable requires careful thought, not only to assure the operator a convenient position of the gun but also to have a minimum of constrictions in the cable hose. It has been found that life is materially lengthened on all welding cables supported only at the terminals. In cases where the center must be suspended (Fig. 5), care is taken to keep the pull to a minimum and to provide a soft sling or shaped clamp around the hose. This minimizes local heating at the point of suspension.

Modern practice also calls for running the cooling water "uphill." This is especially important on cables that have been looped as in Fig. 5 because it overcomes the tendency for air to become trapped at the high spot. Air did become trapped and cables failed prematurely when water ran down the cables. The newer scheme of running water upward tends to carry away the air and restores normal water cooling.

New Electrode-Changing Method

Another detail of operation to be noted is the method of changing welding electrodes. Many failures were caused by draining the cables of water when electrodes were changed and then starting to weld before the cable became filled with water again. This condition can be cured by either changing the tips fast enough to prevent the draining of much water or by allowing sufficient time for the water level to rise before beginning to weld.

Returning to design, a point closely

related to the increased rate of water flow is the better distribution of water within the cable. Autopsies of old-style cables showed that the wires inside the separator were frequently blacker than those outside. This indicated greater heating and consequent softening of the rubber. Tests with thermocouples established that the inner ropes needed 10% more water than the outer ones if they were to run at the same temperature. This relation is obtained by use of a regulating gasket that properly distributes the water.

OFHC Copper

Use of a premium kind of copper known as OFHC (oxygen-free high-conductivity) increases life. Years of experience have backed laboratory tests in demonstrating that such copper has longer life than the electrolytic copper usually found in cables. Although the kickless nature of low-reactance cable removes the major cause of fatigue failure, the extra margin offered by OFHC against failure from the twisting and bending caused by gun manipulation is welcome. The bending stresses in inter-

(Please turn to page 59)

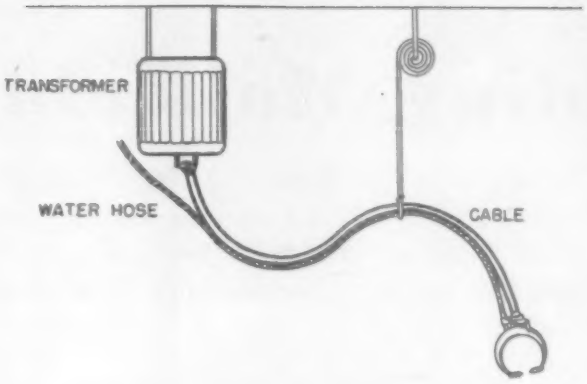


Fig. 5—Looped cable. Cooling water should be run uphill in applications where the middle of the cable must be raised.

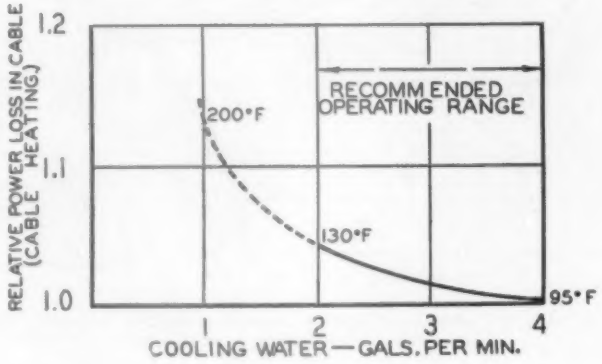


Fig. 6—Chart comparing power losses with cooling-water flow. The principle of decreased power loss from running more water through the cable can lower the electricity bill and greatly increase cable life.

Table IV. Typical Gun-Welder Jobs with Light-Duty and Heavy-Duty Cables

Metal			Welding Procedure					Duty Factor* Applied			Permissible Cable		
Size Kickless Cable	Thickness (inches)	Gauge Steel	Weld "On" Time, Cycles	Total Cycles per Weld	Number of Spots per Group	Active Time per Group—Seconds	Number of Groups per Hour	Factor for Each Weld	Factor for a Group	Complete Factor	Permissible Duty Factor on Cable for Given Length and Current	Length in Feet	Current in Amperes
Light Duty		18–18	12	360		Continuous		0.06	1.00	0.06	0.55	3	14,000
		18–18	6	30		Continuous		0.20	1.00	0.20	0.60	5	10,000
		18–20	4	20	50	16.7	60	0.20	0.68	0.14	0.18	8	14,000
		18–20	12	72	50	60	20	0.17	0.95	0.16	0.48	6	10,000
		20–20	12	20	24	12	75	0.60	0.57	0.34	0.45	8	9,000
		22–22	8	15	32	80	12	0.53	1.0	0.53	0.55	8	8,000
Heavy Duty													
0.143	10		6 × 6 = 36†	6 × 12 = 72†	15	18	20	0.5	0.72	0.36	0.49	3.5	17,000‡
0.143	10		9 × 6 = 54†	9 × 12 = 108†	15	27	20	0.5	0.84	0.42	0.49	3.5	17,000‡
0.125	11		20	40	10	5.0	72	0.67	0.24	0.16	0.32	4	19,000‡
0.094	13		9	17	80	23	6	0.53	0.8	0.41	0.41	5	15,000
0.125	11		6 × 4 = 24†	36	10	6.0	60	0.67	0.34	0.22	0.28	5	18,000
0.060	16		14	20	..	...	..	0.70	0.24	0.16	0.32	10	12,000

* Duty factor is similar to the "duty cycle" commonly used to measure severity of the work. The chief difference is that whereas "duty cycle" is simply the ratio of "on" time to total time, the "duty factor" takes account of the fact that welds are usually made in groups. There is sometimes a great difference between what a cable will carry under steady welding, and its rating when the welding is done in groups. For instance, in the third example under Heavy-Duty cables, "duty cycle" computed in the usual manner is 0.063—much less than the duty factor. In other cases, the difference may be in the opposite direction.

† In pulsation welding, the duty factor for a weld equals the "on" time for all impulses in one weld divided by the total time between welds.

‡ Cable has double water connection at inlet and outlet.

★ RESEARCH

Welding Malleable Cast Iron

To arc weld malleable castings without destroying the "malleability" is a problem that has perplexed many a good weldor. Never let the iron get too hot, advises Mr. Vuchnich in submitting this detailed procedure.

By M. N. VUCHNICH
General Manager, Lincoln Electric Co. of Canada, Ltd., Leeside, Ontario.

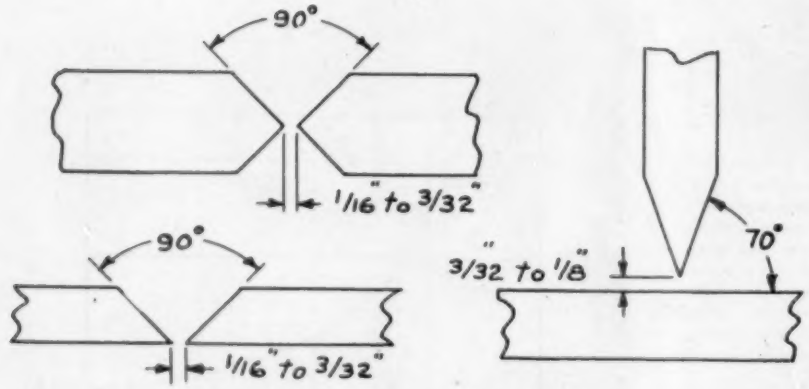


Fig. 1—Methods of preparing work for butt and fillet welds. The work should be beveled to feather edges.

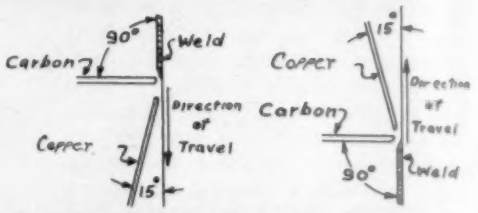


Fig. 3—Electrode and rod angles for vertical welds in which the direction of travel is both "going down" (left) and "coming up." Again, the copper rod leads the carbon in the direction of travel along the weld.

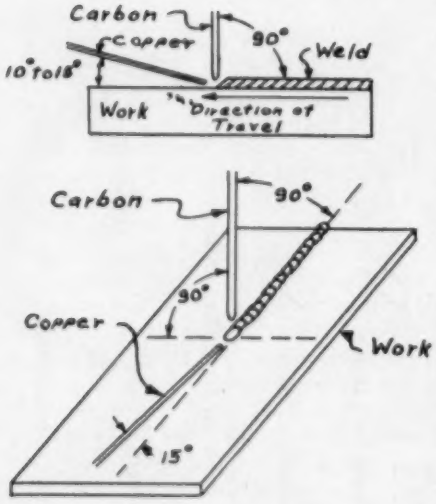


Fig. 2—Electrode and rod angles for downhand welding. The copper rod leads the carbon, which is never allowed to contact the malleable iron during the welding operation.

MALLEABLE cast iron is essentially the same as common grey cast iron in composition. The material contains 1.7 to 5.0% carbon and small quantities of silicon, manganese, sulphur and phosphorus.

Grey and White Cast Irons

Ordinary grey cast iron results when a metal of the above composition is cast as a part and allowed to cool slowly. The carbon, which is soft like graphite, has separated out to form in flakes throughout the material. The metal is soft, easy to machine, brittle and relatively weak, having practically no ductility as compared with steel. The fracture is grey in color; example, a piece of car cylinder block.

When a metal of this composition is cast as a part and cooled quickly, the extra carbon does not have an opportunity to separate itself or come out of solution. The resulting metal is extremely hard and brittle. A broken surface would be white in color; example, a chilled cast-iron ploughshare.

White cast iron thus consists of soft crystals containing iron plus a small amount of carbon encased in a hard network of iron containing the remainder of the carbon. The iron network, which gives the product its characteristic hardness, can be designated "iron carbide" to indicate a hard compound of iron and carbon.

Malleable Cast Iron

In order to produce a malleable iron casting, the part must first be cast as white cast iron; *i.e.*, cooled quickly. It is then packed in slag or sand and heated for four or five days at about 800 C (1,472 F). This high temperature, obviously, would permit the casting to sag or warp, but the packing serves to keep it true. The effect of the prolonged heating is to decompose the iron carbide, so that the carbon in it appears as small particles of graphite which do not break up the continuity of the iron. This form is not the same as the large graphite flakes which are responsible for the brittleness of grey cast iron. The physical properties of malleable cast iron can be readily predicted. Since the graphite has been released from the iron-carbide, the network has become soft; since the graphite is finely divided, the iron carbide becomes ductile.

Can Use Carbon Arc

Malleable cast iron is tough as well as ductile, and has the tensile strength of low-grade mild steel. In order that these valuable properties may be retained during arc welding, malleable cast iron must never be allowed to become too hot, or it will revert to brittle, lower-strength cast iron.

Satisfactory and economical arc welds may be produced in malleable cast iron parts by using the carbon-arc process with a copper-base filler rod and a borax flux. When the procedure is followed properly, the malleable cast iron never reaches a temperature above a dull red, and thus it retains its physical properties. The welding rod used is an alloy of copper, silicon and other ingredients. It has a melting

point of 1,866 F and a tensile strength of 50,000 psi. It tins readily onto the malleable cast iron, and with the carbon arc it can be easily placed where it is required. Welds made in malleable cast iron with this process can be depended upon to produce physical

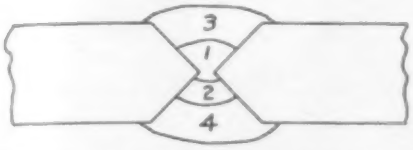


Fig. 4—Schematic diagram of a multiple-pass weld in a double-vee joint.

properties equal to that of the original parent metal. Furthermore, the weld metal is readily machinable.

Equipment and Preparation

The process requires ⅛-in. or 5/32-in. welding rods of the copper-base alloy described above and a supply of 3/16-in. and ¼-in. carbon electrodes. Borax flux (ordinary drugstore variety) is also needed; it not only assists the tinning but also improves the machinability of weld and base metal. A d-c welder should be used, preferably one having separate and continuous controls of voltage and current.

The recommended current settings with ⅛-in. copper filler rods are:

3/16-in. carbons.....50-70 amp.
¼-in. carbons.....60-75 amp.

With 5/32 in. copper rods, only the ¼-in. carbon can be used, and the machine should be set at 80 to 100 amp.

In preparation for welding, all work should be veed out to a feather edge in order to provide an included angle of 90 to 100 degrees. An opening of 1/16 to 3/32 inches at the root is not objectionable. Welds should be made in the downhand position wherever possible, but vertical welds can be made. Fig. 1 shows methods of preparation for vee and double-vee butt welds and horizontal fillets.

In the event that the parts to be arc welded are ½-in. thick or more, a slight preheat may be required before the welding operation is started. Usually, sufficient preheat is produced by passing a 30 to 35 volt carbon arc over the root once or twice.

Welding Procedure

1. Start the weld at one end and at the root.
2. Apply flux to the surfaces.
3. Lay the electrode in the vee and hold the carbon electrode as shown in Fig. 2 for downhand welds. For vertical welds, whether "coming down" or "going up", see Fig. 3. Note that the copper always leads the carbon in the direction of travel.
4. Strike the arc on the copper welding rod and maintain the arc on the molten rod until the latter tins on the malleable iron. The arc should never touch the malleable cast iron during the welding operation. Each pass is applied by placing the end of the welding rod in the molten pool of

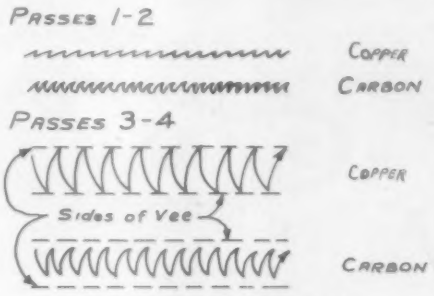


Fig. 5—Carbon and rod motions for the various passes.

copper and melting off a piece into the pool, which is tinned onto the base metal by manipulating the carbon arc.
5. A short arc is used for all welding work.
6. The second pass, using the same procedure, should be deposited from the other side of the vee. The first and second passes should meet at the root. Subsequent passes may be deposited as shown in Fig. 4.
7. If the malleable cast iron becomes cherry red during the welding operation, break the arc and allow the work to cool until it has become black or dull red.
8. Some reinforcement is usually desirable.
9. The carbon electrode motion is from side to side. It differs from the motion of the filler rod as shown in Fig. 5.
10. The welded joint can be allowed to cool in still air. It may even be quenched in water after it has become black.

Advances in Water-Cooled Cable

(Continued from page 57)

leaved cable are less than those in concentric, but the increased cost of OFHC is justified, the author believes, by the violent service anticipated, especially in automotive construction.

Selection of wire-strand size to prevent "needling" has eliminated the plugging of water passages that plagues supervisors who use ordinary cable and some older-style low-reactance cables. Thus one theoretical advantage of kickless cable has been brought to reality.

Other factors tending to increase cable life are the better hose previously described, dependable connections of conductor to terminal and oversize gaskets separating the terminal cap from the base. The latter prevent premature short-circuiting from dirt deposits. Adaptability to all sizes, styles and makes of guns has been enhanced by a wide selection of terminals and adapters.

Resistance and Rating Data

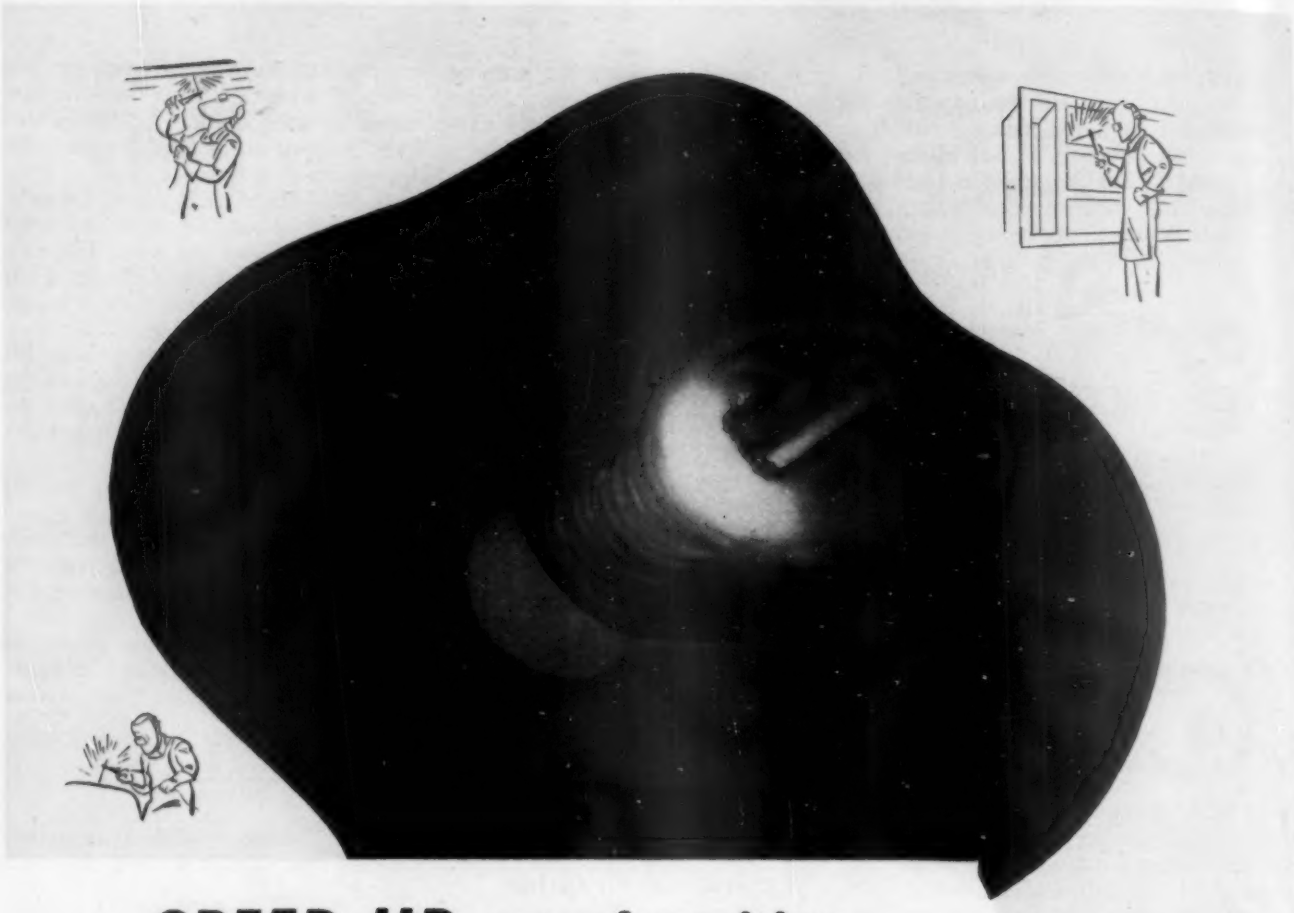
High-conductivity castings for terminals have decreased their resistance. Previous ordinary copper castings had about 30% conductivity, whereas the present ones have about 80%. In many cases this difference is unimportant, but the increased percentage of heavy-current jobs during the war made it imperative to decrease power loss in the terminals so they stay comfortably cool.

Resistance of conductors is lowered indirectly by the improved water supply mentioned before. Since copper resistance goes up 3.5% for each 10 F increase in temperature, considerably less power is lost in a cool-running cable (see Fig. 6). Transformer taps can be set correspondingly lower to get the required welding current.

Commercial laboratory tests yielded information from which the application chart, Fig. 4, was drawn. From this chart, the proper size of cable for a given job may be selected in advance, taking into account both welding ability and welding capacity as defined by AWS. Such selections have been found correct by many actual applications in industry.

Table IV gives some details of operations in which the two standard sizes of cable have been used. The margin of safety is indicated by the excess of "permissible duty factor" over "applied duty factor" (complete factor column).

The improvements described here may be said to mark the transition of kickless cable from the experimental to the commercial stage. Applications during the last few years have been so varied that nearly every imaginable condition has been met and satisfied. The cable manufacturer is interested to see what changes may still be called for to yield maximum life and economy.



SPEED UP out-of-position welds with 3/16"...

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AP is easier to handle . . . it has a fine SPRAY-TYPE ARC. Its DEEP PENETRATION qualities assure strong, lasting bonds and produce X-RAY PERFECT welds. Its unusually LOW SPATTER LOSS means extra footage, increased production. Its exceptionally THIN, EASILY REMOVED SLAG greatly reduces cleaning time. AP gives you all these cost-lowering advantages.

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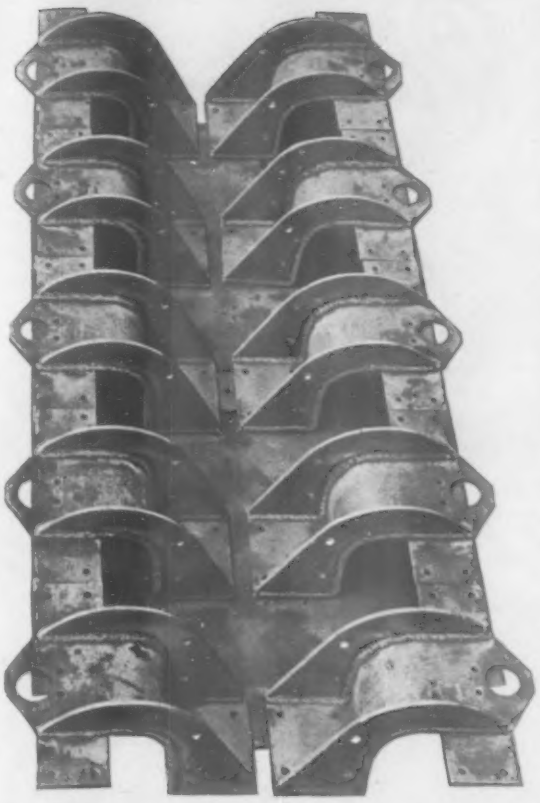
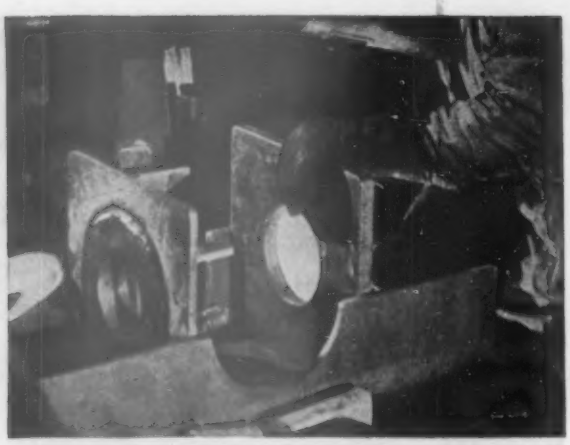
Write for Data Sheet Giving Physical Properties, Applications and Procedures





FOR TACK WELDING — in any position—3/16" AP gives perfect results; quick, deep penetration, eliminating humps.

FOR INDUSTRIAL FABRICATION — in volume production, 3/16" AP provides fast downhand deposition and enables the operator to switch to vertical and overhead work without stopping to change electrodes.

FOR PIPE WELDING — here again, 3/16" AP is a big money-saver for butt welding and joining all types of fittings with its smooth-flowing, deep penetrating arc.

CALL YOUR P&H REPRESENTATIVE

P&H makes a production-proved electrode for every welding requirement: for all mild, alloy and stainless steel applications, cast iron and for building up and hard surfacing.

ON CONSTRUCTION WORK—3/16" AP ends the need for frequent time-wasting changes to smaller electrodes when working from downhand to out-of-position welds.

P&H WELDING ELECTRODES

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HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS • ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

AMERICA'S MOST COMPLETE ARC WELDING SERVICE

DC Welders

AC Welders

Welding Electrodes

Welding Positioners

Welding Production Control Systems

Electric Hoists

Short Cuts and Kinks...

Better Ways to Do It

A FEW of the many time and labor-saving ideas developed by tacticians of the production line are presented every month in this department. If you have a good welding idea of your own to pass along, you are hereby invited to contribute it to this section. Send anything you think suitable to: Short Cuts and Kinks, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5. Payment will be made at our usual rates.

Flame-Cutting Table

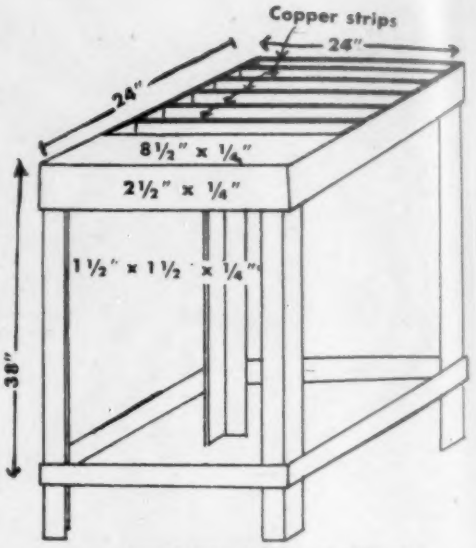
By L. M. Norris

THE conventional table built of iron bars was used for flame-cutting at the Moore Dry Dock shipyard, Oakland, Calif. This table did not stand up too well under flame-cutting and so had to be frequently rebuilt. Before rebuilding, the table would often be so badly out of line that material would be improperly cut and would, consequently, have to be scrapped.

I didn't like the waste of time and materials, so I hit upon the idea of brazing strips of scrap copper bar onto the cross members of our flame-cutting tables. This idea was submitted as a suggestion to the War Production Drive Committee, and it was accepted after a brief demonstration.

The basic principles of the new table are shown in the sketch at top right. The demonstration proved conclusively that the cutting flame could be concentrated on one spot of the copper strip without doing more than heating it to a bright red. The reason for this is that copper does not oxidize readily, even at high temperatures. The same flame concentrated on a strip of steel would cut it in two in a matter of seconds.

A table constructed in accordance with my suggestion does not become damaged by cutting operations. Thus the work remains level at all times, and improper cuts become nearly an impossibility. We found that a table 24 by 24 in. can be protected very inexpensively because no more than 3 to 4 lb of scrap copper will suffice to do the job.



Scrap copper strips increase the life of flame-cutting tables indefinitely.

» «

Helium Welding Stainless

STAINLESS STEEL, a difficult material to arc weld by ordinary methods, can be readily handled by means of "Heliarc" welding. The process was originally developed by Northrop Aircraft, Inc., Hawthorne, Calif., to make it possible to arc weld magnesium. When applied to stainless, the helium gas which bathes the weld acts as a "quencher" to reduce the zone of heat on the parent metal and so keep the temperature from being raised to the danger mark.

A match will go out when held in a bath of helium. Hence oxidation simply cannot occur as long as the helium shield surrounds the weld. Helium thus eliminates the need for a flux and the possibility of flux entrapments to promote corrosion in the weld bead. For all these reasons, helium-shielded welds in stainless steel are stronger than conventional arc welds made in the same metal.

Using an arc torch containing a tungsten electrode, this welder is laying a helium-shielded bead across a joint in a stainless-steel aircraft part.

Key to the Heliarc process is a specially designed torch having a tungsten electrode that projects from a thick tube like the calyx of a lily. The electrode varies in size from 1/8 to ¼ in., depending upon the thickness of metal to be welded and the heat required. The tube connects with a tank of helium under pressure, and a thumb valve is attached to regulate the flow of helium around the arc. As in oxy-acetylene welding, a filler rod is used.

In addition to its uses in the welding of magnesium and stainless steel, this process has proved a successful medium for brass, Inconel, Monel and certain carbon-steel alloys. Research is now in progress to extend its use to aluminum and to other carbon-steel alloys.

» «

Remedy for Power Loss

AFTER resistance welders have been in service for some time, there may be indications of a loss of secondary (welding) power. The capacity of the welder will appear to have dropped, resulting in a lower welding efficiency.

The remedy, according to The Taylor-Winfield Corp., is a simple one of conventional maintenance. The condition is usually caused by (1) a loosening up of the joints in the secondary electrical circuit or (2) oxidation. The joints should be taken apart and either pickled or else thoroughly cleaned by a method such as rubbing with fine emery paper before they are again fitted together.

Taylor-Winfield's chief inspector also suggests silverplating the contacting faces of all the joints, including both sides of the strips forming the flexible bands. This can be done readily by the brush plating method used in many job-plating shops.

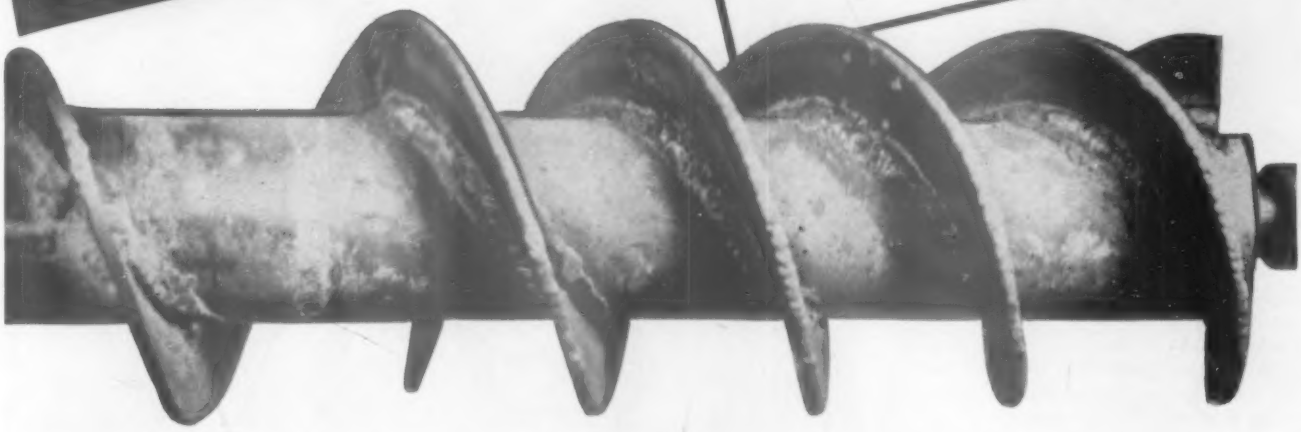
Hard-Facing ANALYZER

THIS MONTH'S WEAR PROBLEM:

CEMENT CONVEYOR SCREWS

Selecting the proper hard-facing alloy for any job must always be based upon operating conditions, which vary infinitely between applications. CEMENT CONVEYOR SCREWS, for example, must withstand:

- **HEAVY ABRASION of steel against cement dust and particles.**
- **INTENSE HEAT from drying kilns.**



CEMENT conveyor screws fight a constant battle against abrasion, often complicated by heat. The fine dust and particles of cement cut away flights as effectively as an emery wheel. As flights lose size, carrying efficiency is also lost. And heat from clinkers does not ease operating conditions.

For all-round wear resistance when heat is a factor, Stoody 6 furnishes best protection on conveyor screws. Stoody 6 is a non-ferrous alloy composed of cobalt chromium and tungsten. It is easily applied; forms smooth, non-porous deposits; retains hardness even at red heat and possesses outstanding wear characteristics.

Stoody 6 is available bare for oxy-acetylene application and in new coated rods for AC-DC electric application. 5/32" rod sizes are priced at $4.25 per pound. Order 10 pounds of Stoody 6 as a trial—it resists abrasion—saves equipment—wherever heat impact or corrosion complicate wear problems.

The $300 cement conveyor screw illustrated above normally lasted only 10 days. At a total cost of only forty dollars, STOODY "6" kept this screw in operation for 60 days—saving approximately $1,500 in a single application! Conveyor screws can be re-hardfaced as required, thus prolonging life indefinitely.

STOODY COMPANY
1141 WEST SLAUSON AVENUE, WHITTIER, CALIFORNIA

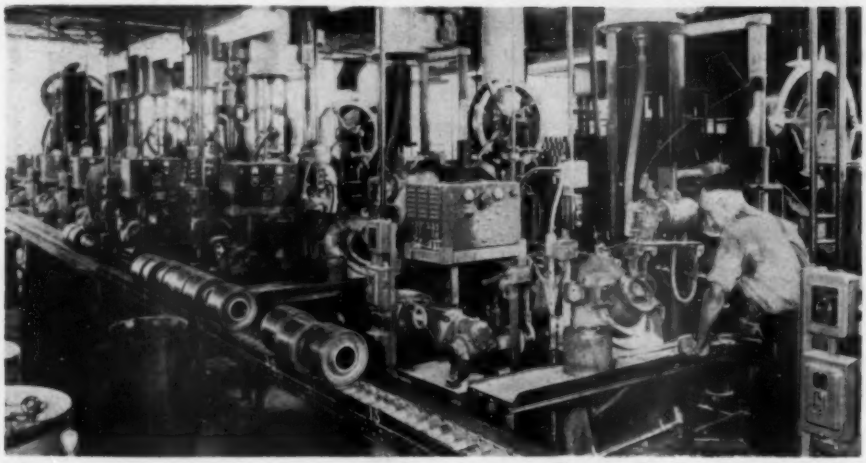
STOODY HARD-FACING ALLOYS
Retard Wear **Save Repair**

On the Job

Mass Welding Wheels

SEVEN submerged-melt welders on a welding assembly line are used to fabricate industrial truck wheels on a mass-production basis (see picture). A power press press-fits the wheels for welding, and a gravity conveyor system feeds the assembled wheels to the various welding stations. Each welding station consists of an automatic welding head mounted as a stationary unit above a mechanized jig. Work is clamped in the jig and rotated at the maximum welding speed. Three machines weld hubs to the flanges; the remaining four make the rim welds. Welding speeds are: 15 in. per min for the rim welds, 12½ in. per min for the hub welds.

Various types of structures involving the use of circumferential welds, plug welds or longitudinal welds can be accommodated.



Courtesy, The Linde Air Products Co.

Fabricating industrial wheels on a submerged-melt welding production line.

» «

Welded Cylinder Block

STUDENTS at the Hobart trade school, Troy, O., learn welding by working on actual practical jobs like cracked cylinder blocks. A typical block job is the one shown in the accompanying pictures, which had a total of 37 in. of cracks and a triangular piece that had fallen completely out (Fig. 1).

The first step in the repair was to clean the parts thoroughly. The cracks were then chipped out to approximately a ⅛-in. vee with a "bantam weight" air hammer and chipping tool. All three sides of the loose piece were beveled to form a vee with the sides of the opening.

All of the welds were made from the start of the cracks to the open end at the rear of the block. To have welded in the opposite direction would have resulted in considerable accumulated stress being locked up at the start of the cracks. A special electrode for welding cast iron was used; it produces a dense yet soft weld that can be peened so effectively as to eliminate almost all shrinkage. Weld beads were kept short—between ½ and 1½ in. long.

All peening was done with a bantam-weight air hammer and peening tool. One student held the peening hammer in readiness while another welded (Fig. 2). The time at which peening started was of the utmost importance to the success of the job; it was begun the instant the deposited metal

Photos, Courtesy Hobart Bros. Co.

Fig. 2—Welding the block. The student with the air hammer is standing by to peen the weld as soon as it has turned to a black heat.

Fig. 1—Cylinder block before welding. Note missing triangular piece.

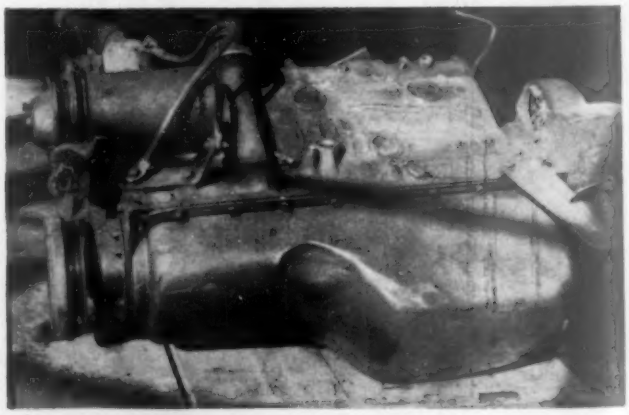


Fig. 3—Cylinder block after welding, grinding and cleaning.

had lost its color. Welding was not resumed until the operator could hold his bare hand on the peened weld. The delay was not long as the mass of metal in the casting quickly drew the heat from the short welds.

After the loose piece had been restored by welding, the beads were ground and the block finished as shown in Fig. 3. Total repair time for the job was seven hours, and the repair was permanent.

» «

Getting the Hook

THE arrester hook shown in the accompanying picture was made not for aspiring vaudeville artists but for Navy combat planes. Hence it has to be strong enough to

Dr. Irving Oehler, research staff of The American Welding & Mfg. Co., is examining one of the flash-welded arrester hooks he helped develop. The hook must be strong enough to check the momentum of a combat plane hitting the deck of a carrier.

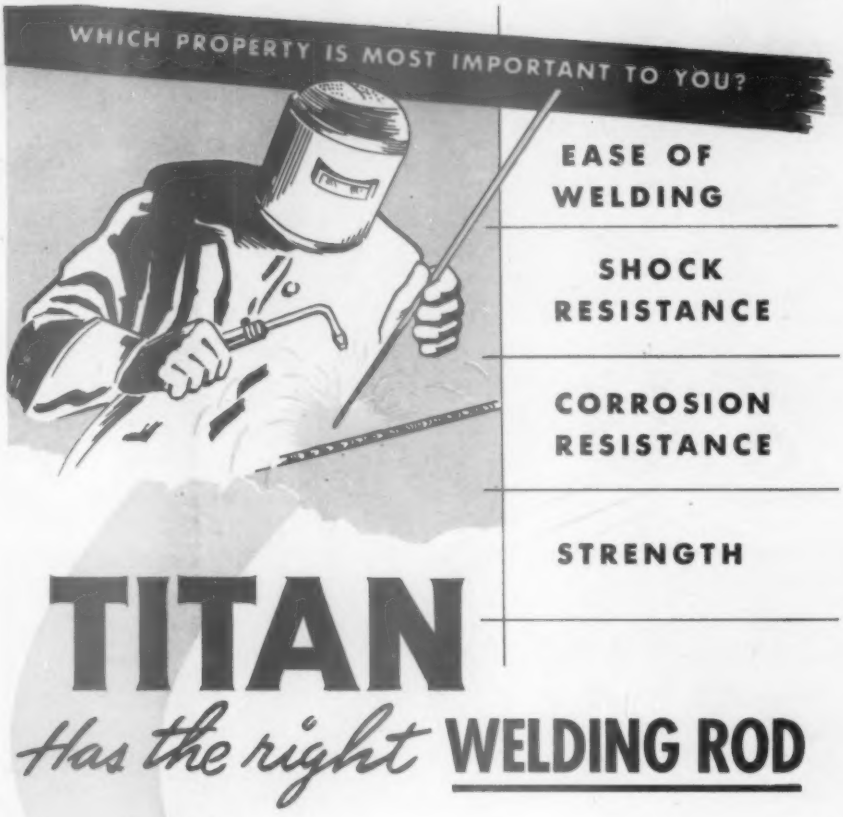
bring the plane to a safe, sure stop on the flight deck of its carrier. To do this, it has to be able to withstand a proof test at the almost unbelievable figure of 180,000 psi.

The hook was fabricated by The American Welding & Manufacturing Co., Warren, O., by flash welding the long shank to the forged headpiece. Flash welding effected considerable savings by simplifying the forging operation.

» «

Welding Aids Foundries

FORK trucks are now being used to handle ladles of molten metal in foundries by means of a simple welded attachment furnished by the Elwell-Parker Electric Co., Cleveland. The attachment is in the form of an apron which slips over the tines of the fork and is held in place with two bolts. Outer edge of the apron is cut away in a semicircle to conform to the ladle's circumference. Brackets are then welded to the upper edge of the apron in alignment with arms on the ladle. The ladle is picked up and transported to molds in a fraction of the time formerly required.



TITAN
Has the right WELDING ROD

The Titan line of Bronze Welding Rods includes seven different types. While all are general purpose rods, applicable to all metals that melt above 1650° F, each type is outstandingly superior in one or more of the above properties. We will gladly assist you in the selection of the right rod for your purpose.

Manufactured from purest materials, all Titan Rods are extruded and cold drawn to size. Double Deoxidized rods by the exclusive Titan process, assures free flow, deep permeation, low fuming, extreme non-porosity and completely sound structure when properly applied.

If your welds must withstand unusual service conditions, submit the problem to Titan metallurgists. Literature on this subject mailed upon request.

Titan
METAL MANUFACTURING CO., BELLEFONTE, PA.
Sales Offices:
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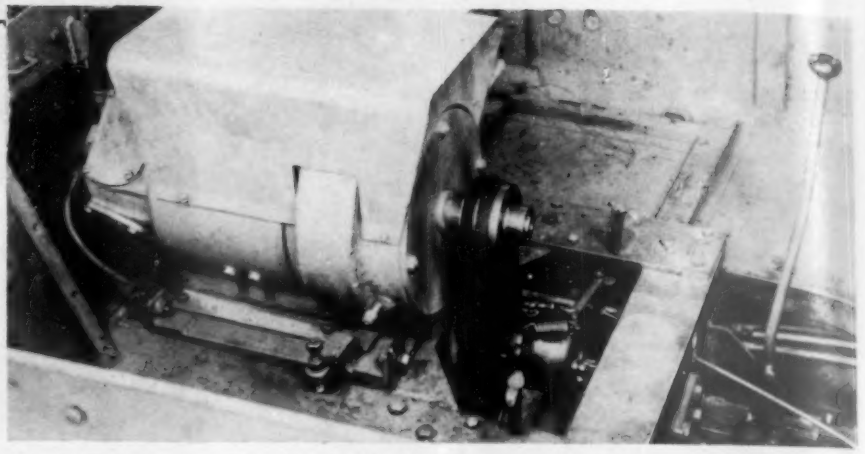
Quality Alloys By Brass Specialists
Brass and Bronze Rod • Forgings • Die Castings • Welding Rods

Amphibious Welder

IT CAN now be told how the famous "Weasel" was converted to an amphibious portable welding shop that could go almost anywhere, get injured equipment repaired quickly for action and then move on to another job. This seeming miracle was accomplished by installing a heavy-duty truck power take-off between the Weasel engine and the differential driving assembly.

"This eliminated the need for a special generator engine, leaving valuable space in the Weasel for working room, materials and personnel," reported Paul H. Davey, president of the Davey Compressor Co., Kent, O. "The installation of the power take-off was much the same as an installation in a 1½-ton truck to drive an air compressor, welding generator, pump, transit mixer, etc. Only minor engineering changes were necessary to adapt our standard equipment to this special Navy use."



Close-up of power take-off used to drive a 200-amp welding generator on the Navy Weasel.

» «

Welded Nail Kegs

REMEMBER the old proverb that goes, "For want of a nail . . . the battle was lost?" The U. S. Navy decided to take no chances after the discovery had been made that the breakage of wooden kegs in overseas shipments was resulting in a loss of nails varying from 10 to 20%. Hence a welded steel drum was developed that could not be burst open by the toughest handling in transit.

The drum was formed of steel sheet and welded at the longitudinal seam. Two gauges were used: 24 gauge for export and 26 gauge for domestic service. The bottom was necked in with a double seam, and rolling hoops were located as near the top and bottom ridges as practicable. Two types of closure were developed: a bolted locking ring and a crimping of the type found on paint pails.

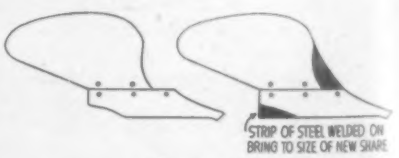
The Navy tested these drums by loading some of them with their full content of 100 lb of nails and dropping them twice from a height of 20 ft onto a paved road. Other drums were dropped into sandy ground similar to Pacific landing beaches.

» «

Plow Blades Reclaimed

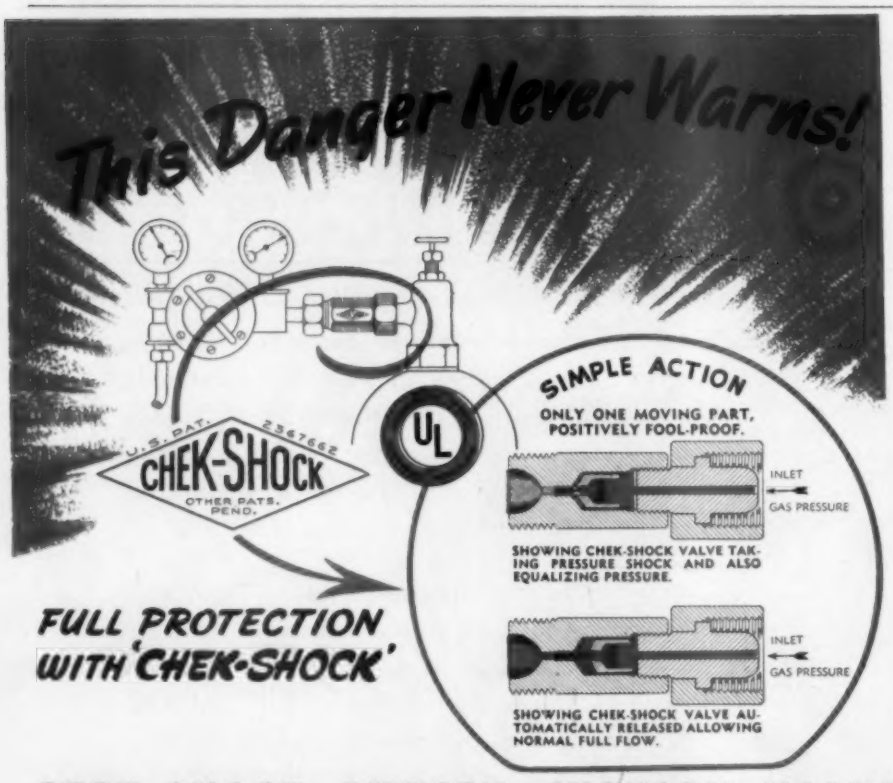
By G. C. Boyer

THE SKETCH below shows our method of patching moldboards. To replace the worn plow blades would ordinarily cost a farmer from $6 to $8. By our method, it is possible to cut out the worn sections and weld in new steel at very much less cost. After the worn sections have been trimmed to a uniform thickness, new strips of steel are fitted into place and welded. The job usually costs about $1.50.



Courtesy, Harnischfeger Corp.

Left: worn moldboard; right: method of renewing the blade by welding on steel strips.



CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).*

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on, (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
2. LIGHT COUPLER—for "airplane" or soldering size oxygen regulators.
3. HEAVY DUTY COUPLER—recommended for extra heavy duty work only.
4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.

$6.00 ea.

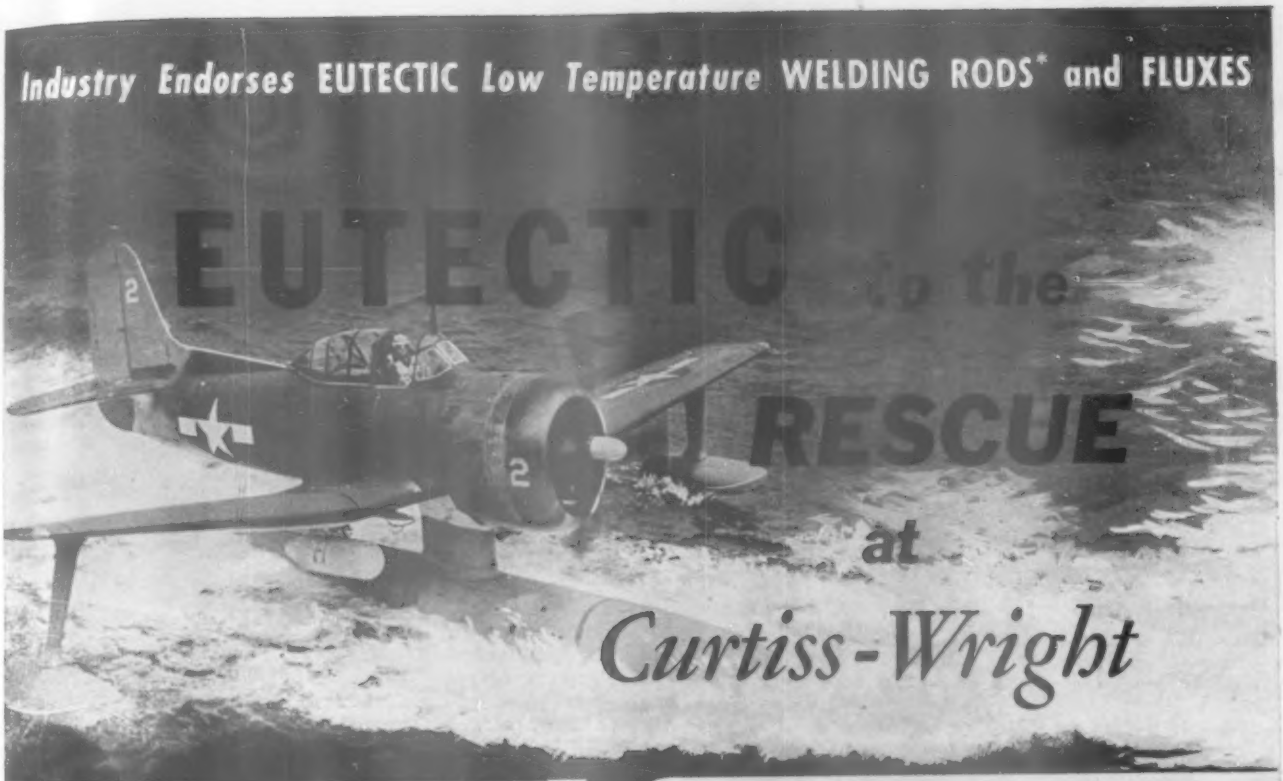
5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).....$7.00 each

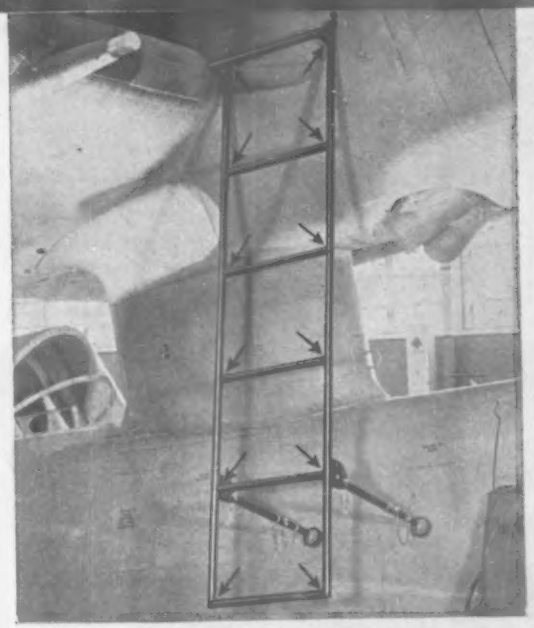
SEE YOUR DISTRIBUTOR OR WRITE

Chek-Shock MFG. CO.

FOWLER CALIF.

Industry Endorses EUTECTIC Low Temperature WELDING RODS* and FLUXES





THE SEAHAWK RESCUE LADDER

All parts (tubes and gussets) were set in a fixture and tack welded with EutecRod 16. The ladder was then taken out of the fixture and finished on the bench. This rod produces small fillets and prevents distortion.

*Trade Mark Reg. U. S. Pat. Off.

MANY American and British fliers downed at sea owe their lives to this famous Curtiss-Wright SC-1 Seahawk whose rugged rescue ladder was the helping hand that reached out to save them from certain death.

Extending from the fuselage to float the ladder folds into a compact unit. Although simple in design the fabrication was a headache to production engineers at Curtiss-Wright. Preliminary gas welding on the collapsible edges resulted in distortion and misalignment.

To lick this problem, EutecRod 16, which forms strong welds at 1300°-1600° F., was recommended. This low heat of application eliminated all danger of distortion and misalignment. The results obtained with this rod were so satisfactory that now it is also used in the production of control handles, brackets and parts of other planes manufactured by Curtiss-Wright including the latest model Helldiver.

WHAT IS EUTECTIC

EUTECTIC Low Temperature Welding Rods are a new type of welding alloys, which—*

1. Bond to base metals well below the base metal melting point. 2. Avoid the dangers of stress and distortion characteristic of fusion welding. 3. Form exceedingly strong bonds through surface alloying.

WHY NOT LET EUTECTIC LOW TEMPERATURE WELDING RODS SOLVE YOUR WELDING PROBLEMS. MAIL COUPON OR WRITE ON YOUR COMPANY LETTERHEAD FOR FULL INFORMATION.

EUTECTIC WELDING ALLOYS CORPORATION
ORIGINATORS OF LOW TEMPERATURE WELDING ALLOYS
40 Worth Street . New York 13, N. Y.

Castolin Eutectic

Please send me complete facts about EUTECTIC Low Temperature Welding Rods and Fluxes and information on how to purchase a selection of the 9 most important EutecRods for everyday use. Dept. IN-1.

Name.....

Company.....

Address.....

New Products to Use

Spot-Welding Tweezers

★ The new "Besco" tweezer spot-welding machine consists basically of a pair of insulated, forged copper tweezers and a foot switch connected to a small cabinet. It plugs into a 115-volt, 60-cycle

"Tweezer Spot Welder" used for welding tiny parts—as small as 0.0005 in. round. It also can be used for heavier gauges.

power supply and may be used to weld parts measuring as small as 0.0005 in. round or thick.

Heretofore, the spot welding of tiny parts has been almost impossible to effect because of the difficulty in holding them in position. These spot-welding tweezers probe for the parts, hold, bend and weld them. The tweezers may be held in the hand with safety, manufacturer declares, because the voltage is low and the current only flows for about 1/1,000 second. The tweezers will not heat up even after continuous usage, states manufacturer.

For the welding of heavier gauge metals where more pressure is required, the tweezers may be removed and the machine connected to a drill press or hand arbor. Copper or copper-alloy rods may be inserted as electrodes, with only the bottom electrode insulated. An auxiliary booster, which increases the capacity of the machine by 300%, aids in welding parts from 0.015 to ⅛ in. round or thick. **Tweezer Weld Corp.**, 280 Plane Street, Newark 2.

» «

Bronze Electrodes

★ A line of five heavy-coated aluminum-bronze electrodes and one phosphor-bronze electrode is announced by Murex. These electrodes cover a wide range of bronze-alloy deposits varying in chemical analysis and in mechanical properties. The deposits will range from high-tensile strength and ductility with comparatively low hardness to medium strength with zero ductility and relatively high hardness. All of these bronze alloys have good wearing and bearing characteristics and excellent corrosion resistance.

Type AB 12 (aluminum bronze) is well suited to the arc welding of manganese bronze castings and brass sheets as well as to "arc brazing" of dissimilar metals. Type AB 16 electrode is recommended for the repair or fabrication of overlays on bearing surfaces subject to shock or impact. Type AB 20 is recommended for repair, maintenance or fabrication of overlays on machine parts subject to unusually severe service, such as building up worn heavy-duty gears and repairing broken gear teeth. Type AB 25 is intended for overlay applications requiring high hardness to withstand extreme wear and heavy pressure. Type AB 30 is employed for overlaying dies for forming and drawing operations on carbon and stainless steels where freedom from scratching and galling of work is required.

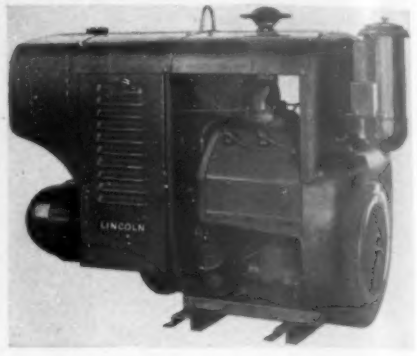
Type PB 57 (phosphor-bronze) is recommended for high speed, quality welding of bronzes, brasses, copper, steel and both cast and malleable iron. It is used in such work as building up bearing surfaces, bronze casting repairs, cast-iron repairs, motor and ring maintenance and repairs to piston rods, pump parts, locomotive guides and copper rivet heater blocks. **Metal & Thermit Corp.**, 120 Broadway, New York City 5.

» «

Mercury-Vapor Arc Lamp

★ A 1,000-watt tubular bulb giving a light equivalent to that of 125 incandescent bulbs of 40-watt size has been developed by the **Westinghouse Lamp Division,** Bloomfield, N. J., for commercial use. The lamp was primarily designed for the lighting of high-ceiling factories, but it may also be used for the lighting of arc-welding booths. The bulb gives a yellow-green light stream from a vapor arc the diameter of a cigarette and twice as long. **Westinghouse Electric Corp.**, P.O. Box 1017, Pittsburgh 30.

Westinghouse mercury-vapor arc lamp. Developed for high-ceiling factories, it may also be used for arc-welding booths.



"Shield-Arc Jr." A new portable welder that can be transported to the field or farm with comparative ease.

New Portable Welder

★ A new 200-amp portable welder of the gasoline-engine-driven type, known as the "Shield-Arc Jr.," should be of particular value for welding applications on farms, oil fields, construction jobs, etc. where electric power is not readily available. It measures 24 by 48 by 30 inches and weighs about 660 lb.

A current range of from 40 to 250 amp permits the welder to be used for light or heavy gauge metal, repair of cast-iron structures such as engine blocks, fabrication of tools and machinery parts, and for the hard-facing of worn parts.

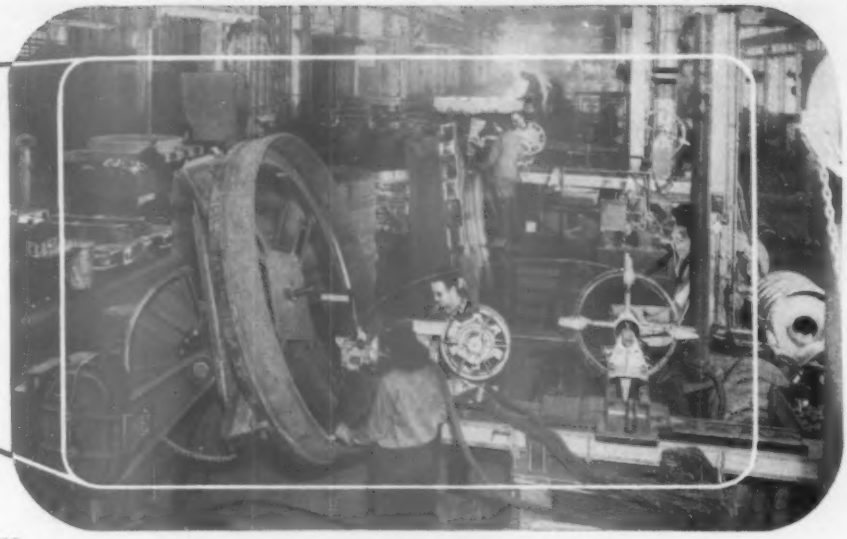
This welder has three ranges of output current obtained by means of a single speed control. It is powered by an air-cooled, four-cylinder V-type engine, speed of which determines the welding current. The output is controlled by adjusting the engine speed between 1,500 and 2,100 rpm. The unit is protected from falling objects and inclement weather by a canopy. Two transverse mounting rails for bolting to a floor or platform permit the welder to be mounted on either a shop trailer or a high-speed two-wheel trailer. **The Lincoln Electric Co.**, Cleveland 1.

» «

Dry Chemical Fire Extinguisher

★ A new extinguisher, effective in all climatic conditions, is designed to eject "All-Out" dry chemical under pressure, in a flat stream that forms a dense, fire-smothering cloud over the flaming area up to a distance of 18 ft. This cloud creates an insulating barrier between the operator and the flame, providing protection against radiant heat. The chemical also forms an insulating film on hot metal surfaces, helping to guard against reflash. **All-Out Fire Extinguisher Division,** 609 W. 134th St., New York City 31.

Setting new standards in production welding



Matching their important contribution to faster production welding for war, C-F Welding Positioners are setting new standards in post-war welding practice. Shops already equipped with C-F Positioners are pacing the field in the race for new markets.

Equipped with variable speed control in any practical speed ratio, from 0 RPM and up, for handling circular or peripheral welds, C-F Positioners are speeding production welding practices everywhere. Speed selection is fast, easily made, permitting quick change-over of material being welded.

C-F Positioners as production tools are changing welding practice from slow, costly operations to faster, better automatic downhand welding. Cost of welding footage is reduced, "overwelding" is eliminated and machine or operator capacity is materially increased. There are hand or power operated C-F Welding Positioners in capacities from 1200 to 30,000 lbs. Write for illustrated bulletin WP 22. **Cullen-Friestedt Company, 1309 South Kilbourn Avenue, Chicago, Illinois.**

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

What DOES IT COST YOU TO HANDLE CYLINDERS?

• Every pair of cylinders that "run-out" in your shop increases your overhead—because the time needed to get full cylinders . . . to switch regulators . . . and to make pressure and flame adjustments is *not* productive.

You can eliminate all excessive cylinder handling costs with a RegO manifold . . . and get other advantages too! Write for full details now.

REGO — ARMY E NAVY

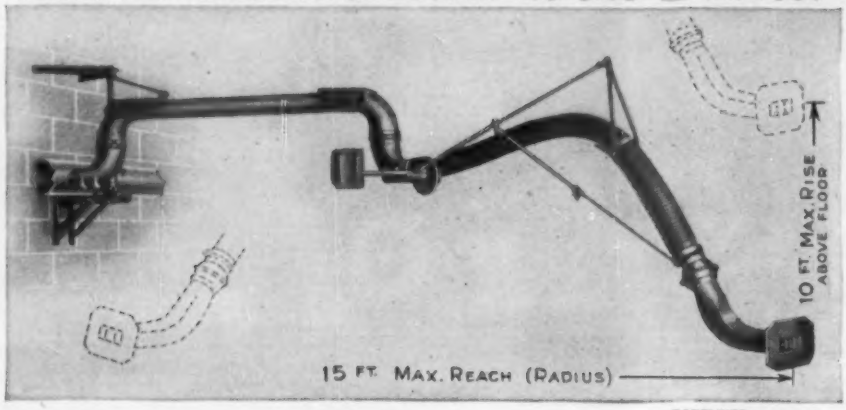
The BASTIAN-BLESSING Company

4239 Peterson Ave. Chicago 30, Ill.

Pioneers and Leaders in Equipment for Using and Controlling High Pressure Gases

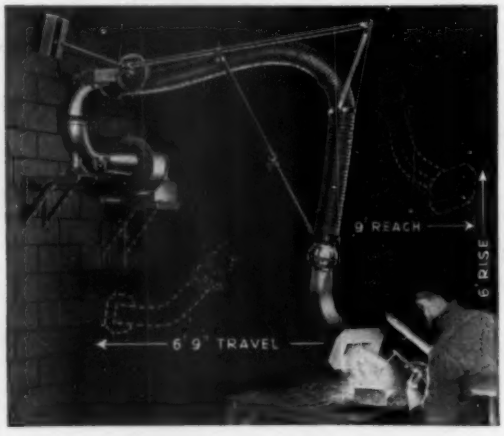
RUEMELIN Fume Collector

REMOVES WELDING FUMES *at the Source!*



PATENTED

LONG REACH MODEL D-5342 — Ideal for large welding booths. Hood reaches out 15 feet from wall. Swivel joints permit inlet hood to revolve in 360° circle for access to all welding positions. Recommended for welding shops having a wide variety of work.



STANDARD MODEL D-5310

Used for standard welding booth ventilation. Hood reaches out 9 feet from wall. A real necessity, especially during winter months when doors and windows are closed.

PATENTED

● Install Ruemelin Fume Collectors to solve your fume removal problem in the most satisfactory manner. Noxious gases, smoke and fumes are drawn away *at the source.* Check these exclusive features:

1. **Guards employee's health against fumes — less welder fatigue.**
2. **Clears shop air with minimum building heat loss.**
3. **Exhaust hood instantly positioned, without using troublesome devices.**
4. **Hood covers maximum welding area, vertically, horizontally and by circle swing.**
5. **Hood equipped with swivelling ball-joint.**
6. **Small amount of electric power used.**

Thousands in daily service in progressive welding shops, metal working plants, railroad repair shops, foundries, structural steel plants, etc. Repeat orders received from many satisfied users. Collectors are available with individual exhaust fans, or with one large fan for multiple collector installations. Engineering data and directions for installing, furnished with each order. Write for Bulletin 37-C and prices.

RUEMELIN MFG. CO.

3880 NORTH PALMER STREET — MILWAUKEE 12, WISCONSIN, U. S. A.

MANUFACTURERS AND ENGINEERS

SAND BLAST AND DUST COLLECTING EQUIPMENT

A 4931-2/3

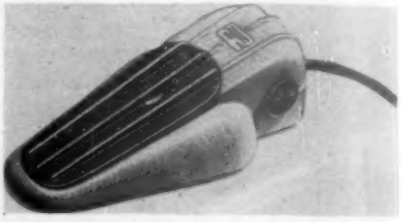
High-Tensile Electrodes

★ The new Murex line of high-tensile electrodes consists of eight numbers: AWS grades E-7010, E-8010, E-9010 and E-10010 (all for use on direct current with reverse polarity) and a companion electrode to each grade having an XX13 coating for use on alternating current or on direct current with straight polarity. Developed to meet the requirements of fabricators of power plant piping and equipment, these electrodes are also applicable to a variety of welding jobs involving high-tensile steels. They depend for their mechanical properties on graduated alloying contents of chromium and molybdenum. **Metal & Thermit Corp.**, 120 Broadway, New York City 5.

» «

"Time-O-Lite" Foot Switch

★ A new foot switch is designed to operate on any a-c circuit. It has silver contacts throughout and employes a



"Time-O-Lite Switch" has many industrial uses including spot welding.

heavy-duty snap-action, single-pole, double-throw switch. Two black outlets, each 1,500 watts, operate electrical equipment when the pedal is depressed, and a red outlet of the same wattage turns it off. The switch may be used to operate spot welders or any motor-driven equipment up to one horsepower. **Industrial Timer Corp.**, 117 Edison Place, Newark 5.

» «

Mild-Steel Electrode

★ A new all-position mild-steel electrode, Airco No. 312, has been designed to prevent underbead cracking in the welding of hardenable steels. Laboratory tests and field applications indicate this electrode is satisfactory for welding low-alloy, high-tensile steels, particularly in heavy sections where preheat must be used with conventional-type electrodes to minimize cracking. It can also be used on free machining steels, which run quite high in sulphur, and cold-rolled steels where excessive porosity is normally encountered with mild-steel electrodes.

For material to be vitreous-enameled after welding, this electrode makes possible the production of satisfactory enameled surfaces without any preheat treatment prior to the enameling operation. Airco No. 312 should also prove suitable for application where stress relieving would be desirable but cannot be accomplished. **Air Reduction Sales Co.**, 60 E. 42nd St., New York City 17.

1928 "Bell-hole" welding of pipe lines, where downhand position welds were not feasible, led to development by A. O. Smith in 1928 of the all-position electrode . . . a great stride forward in the art of welding.

1946 Everywhere vertical and overhead welding is necessary today—in erecting skyscrapers, fabricating bridges, building subways and ships—the SMITHway all-position electrode makes welding the builder's most modern production tool.

MILLIONS of SMITHway Certified Welding Electrodes are used by builders and manufacturers everywhere. More than 320,000 have been used daily in A. O. Smith plants alone . . . in the fabrication of steel products that range from the smallest and simplest to the largest and most complex.

For the proof of SMITHway Electrodes is in actual production—day-to-day plant and field operations, backed by the A. O. Smith program of welding research that never ends.

Write for the SMITHway Welding Catalog for detailed specifications of SMITHway Certified Electrodes and their application to specific welding jobs.

Mild Steel . . . High Tensile . . . Stainless Steel
WELDING ELECTRODES
made by welders . . . for welders

SMITHway
A. C. WELDERS

Reduce Spatter . . . Eliminate Arc Blow. The expanded line of SMITHway A. C. Welders now includes six models—150-, 200-, 250-ampere capacity; and for heavy duty, 300-, 400-, and 500-ampere capacity. Write for prices and specifications.

SMITHway Certified WELDING ELECTRODES

A. O. SMITH Corporation

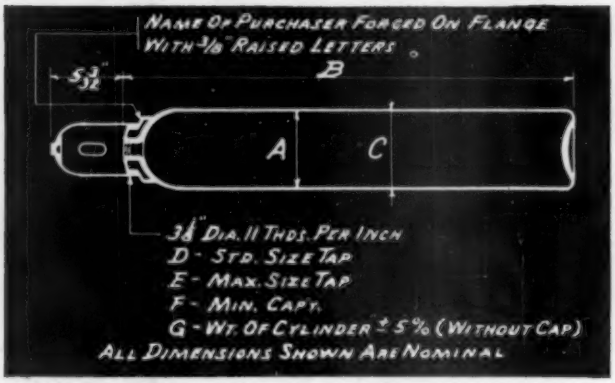
NEW YORK 17 • PITTSBURGH 19 • CHICAGO 6 • TULSA 3
HOUSTON 2 • DALLAS 1 • LOS ANGELES 14 • SEATTLE 1
INTERNATIONAL DIVISION: MILWAUKEE 1 • In Canada: JOHN INGLIS CO., LIMITED

NOW! LIGHTWEIGHT HARRISBURG CYLINDERS in 3 new sizes

Harrisburg again leads the way to more economical and efficient transportation of Industrial Oxygen.

Before the war, the 220 cu. ft. Standard 8½" x 51" Cylinder was generally accepted for use in transporting industrial oxygen.

During the war, the Harrisburg Steel Corporation developed a 300 cu. ft. Lightweight Cylinder of advanced design. This new cylinder has found extreme favor with and has been accepted by compressed gas manufacturers everywhere. And now, as companion cylinders, "Harrisburg" offers a 350 cu. ft. and a 400 cu. ft. cylinder of advanced design. Here are specifications for Industrial Oxygen Lightweight Cylinders with emphasis on the new sizes.


NAME OF PURCHASER FORGED ON FLANGE WITH 3/16" RAISED LETTERS
B
A
C
3/4" DIA. 11 THDS. PER INCH
D - STD. SIZE TAP
E - MAX. SIZE TAP
F - MIN. CAPY.
G - WT. OF CYLINDER ± 5% (WITHOUT CAP)
ALL DIMENSIONS SHOWN ARE NOMINAL

INDUSTRIAL OXYGEN

Cap'y Cu. Ft.	A Inches	B Inches	C Inches	F Cu. In.	G Lbs.	I.C.C. Spec.	Test Pres. Lbs. per Sq. In.
	Std. size tap, ¾". Max. size tap 1". Detail Sketch Number on Request.						
55	5½	32	5⅞	660	29	3A-2015	3360
110	8⅜	43	6 11/16	1320	57	3A-2015	3360
125	8⅜	43	7	1320	64	3A-2265	3775
220	8½	51	8 13/16	2640	105	3A-2015	3360
250	8½	51	9	2640	115	3A-2265	3775
300	8¾	55	9¼	2990	131	3A-2400	4000
350	8¾	55	9¼	2990	153	3A-2800	4670
400	9 1/16	54¾	9¾	3210	174	3A-3000	5000
400	10 1/16	55½	10⅜	3985	186	3A-2400	4000

Specify Harrisburg LIGHTWEIGHT Cylinders for the transportation of Industrial Oxygen, Medical Gas, Carbon Dioxide

HARRISBURG STEEL CORPORATION
HARRISBURG, PENNSYLVANIA

"StaSafe" face shields allow rapid replacement of visors.

"StaSafe" Face Shields

★ These shields are made to permit quick changes of visors with the least number of movements. A phosphor-bronze spring-retaining clip locks the visor into position. The operation of replacing visors is done by lifting the retainer clip and sliding the new front into place. **Standard Safety Equipment Co.**, 232 W. Ontario St., Chicago 10.

» «

A member of the new U.S. Gauge line. These gauges are easy to read and give longer life.

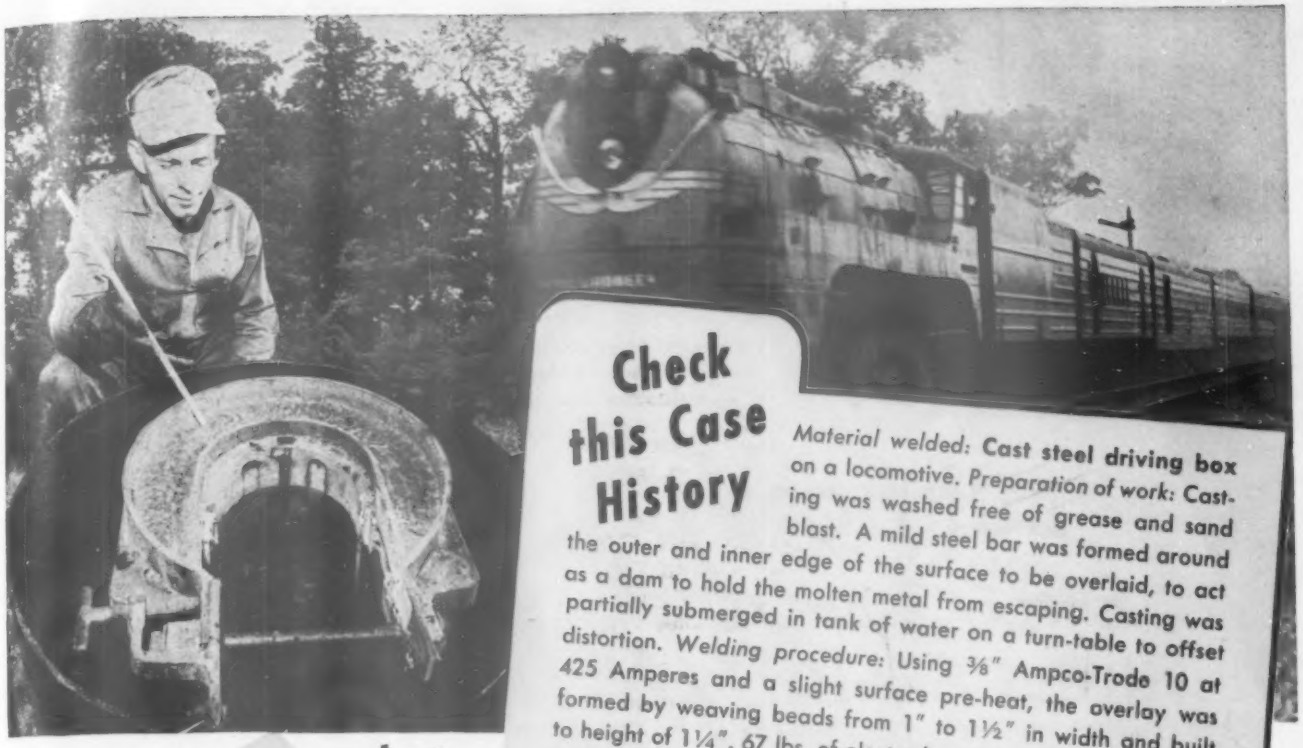
New U.S. Gauges

★ A new line of streamlined gauges including gauges for oxy-acetylene welding and cutting equipment is announced by **The United States Gauge Division, American Machine and Metals, Inc.**, Fidelity-Philadelphia Trust Bldg., Philadelphia 9. Each gauge has an ivory-toned dial with red-and-black graduations.

» «

"No Fog"

★ "No Fog," a cream used to prevent the fogging and steaming of windshields, eye glasses, goggles and respirators, is now available in collapsible tubes. The **Carhoff Co.**, 12114 Woodland Ave., Cleveland.



Check this Case History

Material welded: **Cast steel driving box** on a locomotive. *Preparation of work:* Casting was washed free of grease and sand blast. A mild steel bar was formed around the outer and inner edge of the surface to be overlaid, to act as a dam to hold the molten metal from escaping. Casting was partially submerged in tank of water on a turn-table to offset distortion. *Welding procedure:* Using 3/8" Ampco-Trode 10 at 425 Amperes and a slight surface pre-heat, the overlay was formed by weaving beads from 1" to 1½" in width and built to height of 1¼". 67 lbs. of electrode were used; seven hours of welding time required. *Results:* A long-wearing bearing surface overlaid with a minimum of cost, labor, and time.

Railroads and other heavy industries extend the life of mating surfaces with AMPCO-TRODE

REG. U. S. PAT. OFF.

COATED ALUMINUM BRONZE ELECTRODES

Ampco-Trode has been used successfully on the following:

- Driving Box Face
- Steel Piston Heads
- Steel Pop Valve
- Fabricate Oil Cellars
- Valve Crossheads
- Trailer Boxes
- Worn Shoulders on Crown Brass
- Steel Crosshead
- Brake Rod Equalizer Ends
- Wear Shoes
- Bumper or Chafing Plates
- Spring Carriers and Hangers

This is the way railroads are building long-wearing surfaces on frictional parts. Another outstanding operating railroad has standardized on Ampco-Trode 200 for overlaying **engine roller-bearing shoes** because *"it has proved itself over and above softer bronzes."*

You can select Ampco-Trode electrodes on their record — with full knowledge that superior strength, higher hardness and wear resistance will be in evidence when you make your trial-run check. On all parts subject to wear, fatigue or corrosion, specify Ampco-Trode . . . it lasts three to five times longer than ordinary bronzes . . . you cut "down time" to a minimum . . . you avoid frequent and costly replacement.

Ampco distributors and field engineers are happy to assist you in solving your problems by surfacing with Ampco hard bronze overlays. Send the coupon today for additional information on overlaying with Ampco-Trode.

AMPCO METAL, INC., Dept. WE-2, Milwaukee 4, Wisconsin

Please send Ampco-Trode Bulletin W3.

Name.....

Position.....

Firm.....

Address..... ☐ Home ☐ Business

City.....(.....) State.....

TEAR OUT COUPON! MAIL TODAY!

AMPCO Metal
The Metal without an Equal

W-86

Power-Driven Shears

★ "Steelweld" power-driven metal-cutting shears are said to be radically different from all cutting devices of this character. A new pivoted-blade is employed in place of the guillotine-type shears. The upper blade operates on two heavy pivot pins secured to the end housing and travels in a circular path. Hence there are no slides or guides to wear out and cause inaccuracies.

A valuable feature is the ease with which the knife clearance may be varied to suit the thickness of the plate to be cut. Turning a hand crank changes the gap between the knives, and a large dial indicates the clearance in thousandths of an inch. Other features include: spring-operated mechanical hold-downs and an operating back gauge mounted on ball bearings. The operating crank and dials are located at the outside front corner of the shear. The shears may be arranged for squaring, slitting, or may be set at any intermediate position for notching. Both frame and blade are of all-welded one-piece construction.

"Steelweld" power-driven cutting shears for accurate cutting over a wide range of thicknesses.

Steelweld shears have been developed in various sizes for cutting plates of thicknesses from 12 gauge to 1¼ in. and for lengths ranging from 6 to 16 ft. Speeds range from 60 strokes per minute on the smaller shears to 25 strokes per minute on the largest size. **The Cleveland Crane & Machinery Co.**, Heavy Machine Div., Wickliffe, Ohio.

» «

Hard-Facing Electrodes

★ One new and one improved Lincoln "shielded-arc" hard-facing electrodes are now being manufactured. The new electrode, "Abrasoweld AC," is suitable for building up straight carbon, low-alloy or high-manganese steel parts with a self-hardening deposit to resist severe abrasion, battering and impact. Although designed for a-c operation, it may also be used on d-c welders. The weld metal is of the semi-austenitic, self-hardening type. It is abrasion-resisting and hardens very rapidly under conditions of impact and abrasion. Peening will increase as-deposited hardness from 20-40 to over 50 Rockwell C. The weld metal maintains its toughness and develops its maximum hardness only at the surface where it is cold worked. The cushion of softer metal beneath the surface serves to eliminate checking and flaking so common with abrasion-resisting electrodes. The deposit, states manufacturer, is more resistant to corrosion than high-manganese steel. "Abrasoweld AC" is furnished in ⅛, 5/32 and 3/16 in. sizes, 14 in. lengths.

"Manganweld A," suspended for the duration, is now being remanufactured in an improved form. This electrode is used for reclaiming worn austenitic manganese steel parts containing 11 to 14% manganese. It is well suited for use with d-c welders and may be used with a-c welders of both industrial and small, mass-market types.

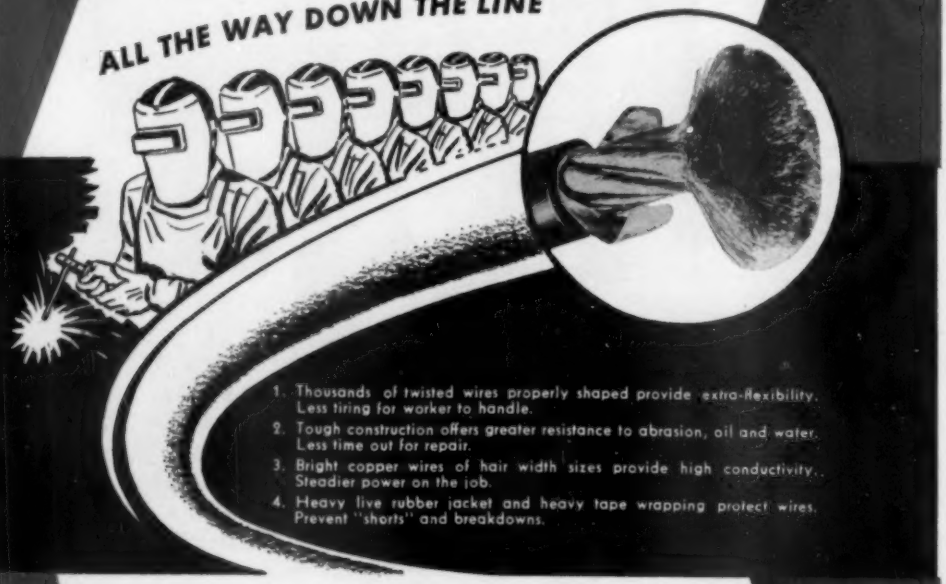
Generally recommended for flat work only, this electrode produces a deposited metal having a resistance to abrasion and impact that is equivalent to heat-treated cast manganese steel. Weld metal as deposited has a hardness of 5 to 10 Rockwell C, but cold working increases the hardness to 45 to 50 Rockwell C. "Manganweld A" is recommended for all resurfacing and building-up applications of high-manganese steel, and it is sometimes applied as a tip bead where an abrasion-resisting surface is required. It is furnished in 5/32, 3/16 and ¼ in. diameters, 14 in. lengths. **The Lincoln Electric Co.**, Cleveland 1.

COMING NEXT MONTH
Annual Welding Directory

BURDOX

Extra-Flex CABLE DELIVERS *Extra Values*

ALL THE WAY DOWN THE LINE



1. Thousands of twisted wires properly shaped provide extra-flexibility. Less tiring for worker to handle.
2. Tough construction offers greater resistance to abrasion, oil and water. Less time out for repair.
3. Bright copper wires of hair width sizes provide high conductivity. Steadier power on the job.
4. Heavy live rubber jacket and heavy tape wrapping protect wires. Prevent "shorts" and breakdowns.

To get the greatest value in welding cable, order Burdox EXTRA-FLEX every time! Its abundance of hair-thin copper wires delivers a full steady stream of power . . . means more welds completed per man-hour. Because it coils readily, it is easier to handle . . . means less fatigue and better welds. Heavy jacket prevents breakdowns . . . eliminates time losses. EXTRA-FLEX Cable gives you many extra values, yet costs far less than you would expect. Order a supply today from your welding supply distributor. Sizes from 6 to 4/0.

THE BURDETT OXYGEN COMPANY
3302 Lakeside Avenue — Cleveland 14, Ohio

ADDED SAFETY . . . GREATER COMFORT—BURDOX LIFT-FRONT GOGGLES

A new development in eye protection. Goggles are mounted on arms without pressure on nose . . . stay up or down. Headgear protects entire forehead. Write for literature.

Midget Spot Welder

★ Supplementing the Universal line of 1-kva and 3-kva air-operated bench-type welders is a new 7½-kva model. The

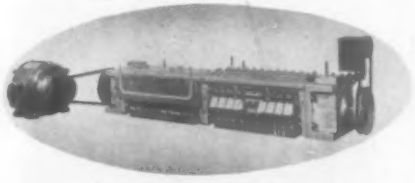
Universal 7½-kva bench-type welder can be used for a variety of materials, including 16-gauge steel.

USP-7½ is equipped with solenoid valve control for the air cylinder, water-cooled transformer and water-cooled electrodes. It can be furnished with a built-in electronic timer or with separate timer panels. An adjustable switch provides a wide range of pressures for the welding of non-ferrous metals, wire, etc. The USP-7½ will weld up to two pieces of 16-gauge steel. A foot switch initiates the welding cycle. **Universal Welder Corp.**, 760 Carnegie Ave., Cleveland 15.

» «

Welder Control Unit

★ The "Ultra-Speed" welder control unit was designed to meet the increased demand for fully automatic multiple-spot resistance welders. The new unit dis-



Progressive "Ultra-Speed" welder control dispatches individually timed welding current to from 10 to 100 or more welding guns.

patches individually timed welding current to from 10 to 100 or more guns, each adjusted to its own proper welding pressure. Welding rates up to 900 spots per minute are possible to speed the assembly of complicated parts in a single set-up.

The new control distributes welding current to a single welding point or group of welding points successively by means of a screw-driven carriage that depresses push rods to engage contacts. At the same time another element of the carriage engages adjustable-stroke plungers to control individually the length of time the welding current flows for each weld. All points bear on the work simultaneously under pressure before the first weld is formed, and the pressure remains until the last weld is completed.

"Ultra-Speed" controlled machines can be built to accommodate an almost unlimited range of weld spacings and locations. The welding guns can be arranged in single or multiple rows, circles, steps, curves, etc., either closely spaced or spanning the full width of large panels. Individual timing of each welding gun permits the different thicknesses of metal to be spot welded during one complete operation.

Cams are interposed between the tappets actuating the contacts to assure the opening of each welding circuit before the next circuit can be closed. A one-piece, removable water-cooled feed bar using a pressure of 1,100 psi is mounted on each side of the unit. **Progressive Welder Co.**, 3050 E. Outer Drive, Detroit 12.

» «

Floor Cleaner

★ Optimus floor cleaner No. 1F10 is designed to remove oil, grease and other dirts from the surface, without harming the finish in any way. This cleaner helps keep floors in good condition, makes them less porous and prevents dusting. **Optimus Detergents Co.**, 248 Church St., Matawan, N. J.

SAVE TIME USE A
CMD
WELDERS CHIPPING HAMMER
With steel or wooden handle. Light weight. Strong. Easy to use. Write for circular.
TYPES EB and FB
Models E and F can be supplied with brush as shown here. Brush can be replaced by unscrewing countersunk screw in bracket and removing.
TYPE F
Head has two chisels at right angles.
TYPE E
Head has drift and chisel.
TYPE A
Has drift and chisel. Widely used in malleable and grey iron foundries for general chipping.
TYPE CB
Combines 3 tools in 1—drift, chisel and removable wire brush.
TYPE C
Same as Type CB, but without brush.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

Off the Floor Deliveries!
ON
TRINDL SUPER INDUSTRIAL ARC WELDER
DESIGNED FOR HIGH SPEED PRODUCTION ARC WELDING

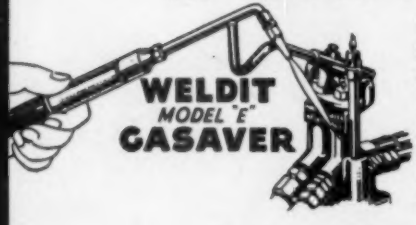
TRINDL SUPER INDUSTRIAL ARC WELDERS, the result of many years of careful engineering and "job tested" research, are rolling up impressive production records. Acclaimed for superior performance, ruggedness, dependability, and economical operation.

For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

TRINDL PRODUCTS, LTD. 11 EAST 23rd STREET AR CHICAGO 16, ILL.

Safe Welding
AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT INC.
628 BAGLEY AVENUE • DETROIT 26, MICH.

Blacksmith buffer and grinder. The blacksmith's aid for grinding and buffing plowshares and other long pieces.

Blacksmith Buffer and Grinder

★ This low pedestal-type buffer and grinder is designed for use in blacksmith shops for the grinding and buffing of plowshares and other long, odd-shaped pieces. Over 40 in. of working space between the wheels and pedestal enable the worker to sit at the work and brace the piece between his protected knee and the buffing wheel. These grinders are fabricated from rolled sheets and welded to insure lightweight, sturdy construction. **The Hobart Brothers Co., Motor Generator Division,** Hobart Square, Troy, Ohio.

» «

"Midget-6" portable plastic dip tank. It weighs 16½ lb and can be brought to dipping temperature in minutes.

"Plast-O-Dip" Tank

★ A one-gallon plastic-coating tank has been designed to apply protective coating to plugs, gauges, carbide-tipped tools, etc. This unit was developed to meet the demand for smaller sized plastic-dipping equipment for processing in tool rooms and small plants. **Aeroil Products Co.,** West New York, New Jersey.

COMING APRIL!

1946 Annual Statistical Number and Directory of Welding Products and Equipment

★ MAINTENANCE

Traveling Welding Shop

To work 40 ft below a river bottom or in a gasoline storage tank is all in the day's work to Barney and J. R. Dougal, who go anywhere and weld anything.

By **I. M. DURNIN**

Here the Dougal Brothers are slotting 2,000 ft of 12 in. well casing for the Boise Water Corp.

THE emphasis placed on the reconditioning of old machinery during the past four years has caused welding to assume an important place as a salvage procedure by which worn parts can be restored to their former efficiency. To meet the demand for this work, Barney Dougal and his brother J. R. Dougal, of Boise, Idaho, have organized what might be called a traveling machine shop. It is mounted on wheels and can be taken any place that a breakdown calls for its services.

From Boilers to Gas Tanks

Recently the Dougal brothers' shop —or a portion of it—was transported several hundred miles to do a job of laying out, cutting and arc welding thirty-two 5-in., 40-deg pipe ells, 32 risers and a number of large 8-in. steam boiler headers, also boiler breachings. Another big job was to steam, clean and weld a number of large gasoline storage tanks. "We are happy to say that we completed one of our most hazardous jobs without a single accident," reports Barney. "We caulk welded about 16,00 rivets and 3,600 ft of longitudinal and circumferential seams. This job took four months to complete."

In the past year and a half Dougal Bros. Combination Welding and Metal Work Shop has completed approximately 50,000 ft of 6-in. and 8-in. pipe line. All fittings—including every degree and type of fitting that can be made from pipe—were cut and welded right in the field.

Another important out-of-town job was to braze about nine tons of copper tubing in a sugar factory. The tubing ranged in diameter from 1 to 4 in. The job of brazing it in place was finished in about six weeks.

Working under Pressure

Exceptionally difficult to accomplish was an order to straighten the fins on a hydro-electric scroll case 40 ft below the river bottom. All tools and welding equipment were lowered to this level, and men in hip boots worked night and day with pumps going full blast to keep the water down. Suddenly the power went dead; the pumps stopped, and there was a wild scramble to the surface to keep from being drowned. All of the equipment had to be left below, but it was recovered and salvaged when the pumps started to operate again. The finished job is regarded as a welding marvel by men who appreciate fine workmanship under difficult conditions.

The Dougal brothers permant shop, located at 202 W. 15th St., Boise, is well stocked with the most modern equipment available, including an arc welder with remote control, flame-cutting apparatus, a portable acetylene generator, a metal lathe of latest design, a mechanical steel hack saw and hundreds of hand tools. This fine line of equipment permits the shop to turn out a large amount of work such as welding broken motor blocks, cross members, frames, mufflers, smashed fenders, etc. Anything and everything is all in the day's work for these versatile welding specialists.

This One Respirator does the job of Four

Yes, workers get 4-way safety with this Willson respirator. Protects lungs against 4 different industrial hazards. Metal fumes. Pneumoconiosis-producing dusts. Toxic dusts. Nuisance dusts.

Two double filters provide extra-large filtering area. Give workers the greater comfort of free-and-easy breathing. Filters are throw-away type. May be easily, inexpensively replaced.

Face piece available in two sizes to fit either small or large face. Both sizes carry Bureau of Mines approval. Compact, the respirator may readily be worn under a welding helmet.

For help on your lung-protection problems, get in touch with your Willson Distributor or write direct to Dept. WE-12.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

READING, PA., U. S. A. Established 1870

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Scientific Industrial Reports

The first issue of the "Bibliography of Scientific and Industrial Reports" is now on the market. Most of the information given was obtained in Germany and in countries formerly occupied by the Germans. This issue comprises 28 pages, covers 323 reports pertaining to such subject headings as electrical machinery, fabricated metal products (except ordnance, machinery and transportation equipment) and primary metal industries. Available at 15c per copy from the **Superintendent of Documents, Government Printing Office,** Washington 25, D. C.

» «

Handbook of Stainless Steel

A 100-page pocket-size 5x7½x⅛ in. handbook published by **Allegheny Ludlum Steel Corp.,** Brackenridge, Pa. presents information on 26 types of stainless steels. It brings up to date and amplifies the stainless-steel chapters of the company's earlier "Handbook of Special Steels." An interesting feature is a 44-column "finder chart" giving analyses, properties, hot working temperatures and heat treatment of the different types of stainless.

Fabrication methods and procedures occupy a total of 40 pages and include welding methods, press forming, riveting, shearing, soft soldering, silver soldering, annealing and heat treating, polishing and buffing, surface treatments such as the removal of welding flux, etc.

Stainless steel products, plates, sheet, strip, bars, forging billets, tube stock, etc., are described in a 20-page section. Final pages contain general tables of bar weights, weights of sheet, weights of tubes, feet per pound of wire, decimal equivalents of fractions of an inch, and temperature conversion.

» «

"Weld-It" Bulletin

Newly published is an interesting bulletin concerning spot, seam and projection welding, and the world's largest flash-butt welder. The material in this four-page bulletin ranges from the uses of spot welding in kitchenware manufacture to the seam welding of large steel sheets. In particular is discussed the use of resistance welding by aircraft industries—the field in which the new vertical flash-butt welder comes into play. The machine is used to join solid steel shafts to the turbine bucket wheels of jet propulsion engines (page 54, February, WELDING ENGINEER).

The bulletin is supplemented by photographic reproductions and a blueprint drawing of the new flash welder. The **Taylor Winfield Corp.,** Warren, Ohio.

» «

"Ampco-Trode" Bulletin

An eight-page, letterhead-size bulletin describes the five grades of coated aluminum-bronze electrodes, giving chemical composition, physical properties and recommended applications for each grade. The booklet explains how "Ampco-Trode" and "Phos-Trode" can solve difficult welding problems.

A new color code in vertical position is listed for bronze electrodes and specifies a primary color for phosphor-bronze electrodes plus primary and secondary colors for aluminum-bronze electrodes. Ask for Bulletin W3, Ampco Welding News. **Ampco Metal, Inc.,** 1745 So. Thirty Eighth St., Milwaukee 4.

» «

Welding Accessories Folder

A complete new line of arc welding accessories is described and illustrated in a two-color Hobart folder (DM-709). Many different items are properly identified with catalog numbers for simplification. **Hobart Brothers Co.,** Box DM-709, Troy, Ohio.

» «

Bronze Electrode Bulletin

An eight-page letterhead-size bulletin covers the new Murex line of coated aluminum-bronze and phosphor-bronze electrodes for d-c welding. For each type of electrode, there is given a table of such data as polarity, color identification, chemical composition, sizes and physical properties. Photographic illustrations show typical welding applications. **Metal & Thermit Corp.,** 120 Broadway, New York City 5.

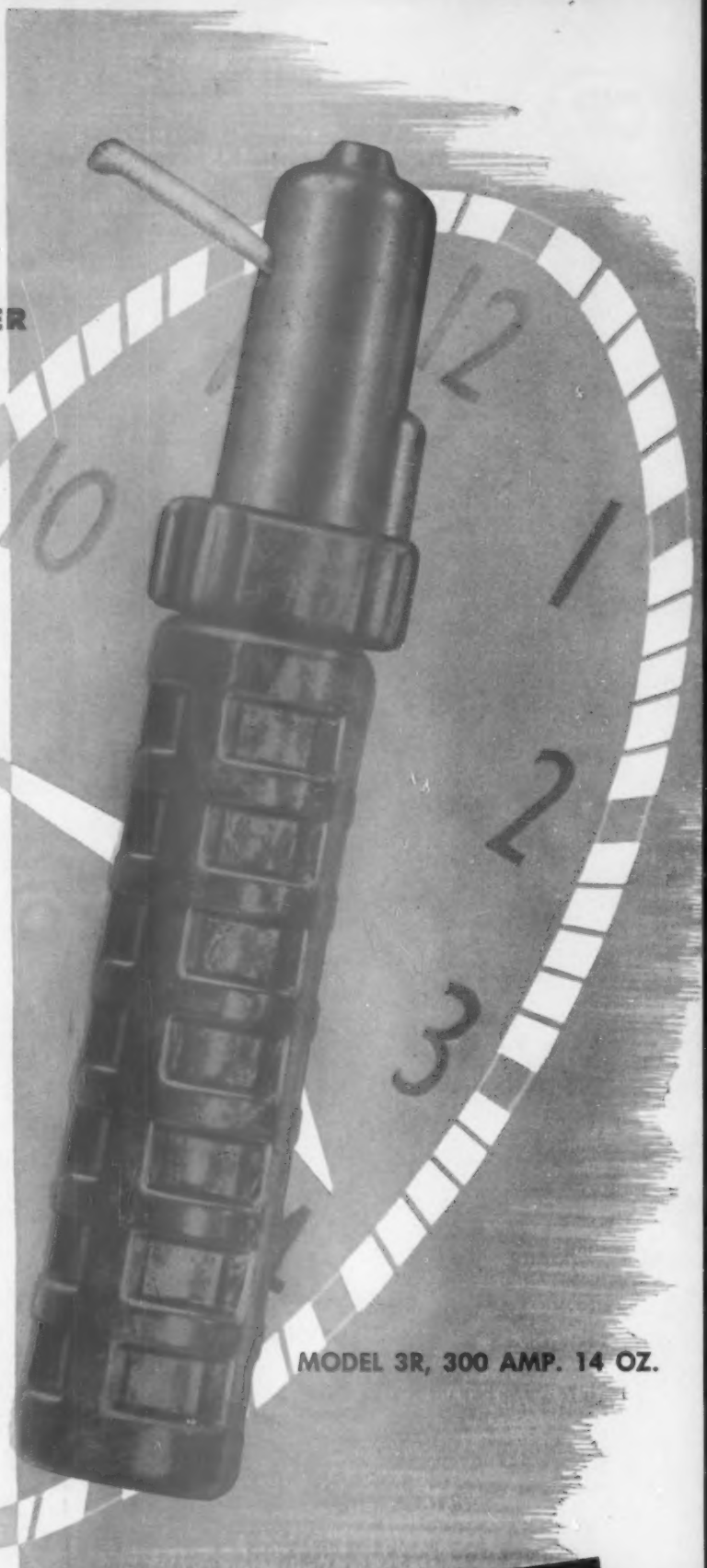
» «

"Heliarc" Welding Pamphlet

A four-page letterhead-size circular describing the "Heliarc" welding process and its various applications and advantages is released by **The Linde Air Products Co.,** 30 East 42nd St., New York City 17.

MARTIN WELLS' *Stubby* HOLDER

Gives more ARC time



MODEL 3R, 300 AMP. 14 OZ.

100% Insulated; Cuts Down Accidents

1. Stubby, with new "Mitt-Grip" collar, makes rod changing easier and quicker. Collar lasts indefinitely. Insulator cap may be replaced without changing collar and without special tools. So, Stubby spends more time on the job, less in the repair shop.
2. Higher electrical conductivity, due to special construction of vise body, delivers *full amperage* to the rod. Sturdy, but lightweight construction protects Stubby when overloaded.
3. Stubby's perfect balance, due to streamlined design and light weight, helps operator maintain high weld-footage throughout the shift. Because it is 100 per cent insulated, Stubby does not have accidents.
4. Stubby's high pressure grip holds rods firm, enables operator to use rods down to the last 1½". Stubby has no springs to get tired.

Stubby WILL GIVE YOU MORE ARC TIME

WRITE OR WIRE NEAREST DISTRIBUTOR

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Grand Rapids—Air Reduction Sales Co.
Harrisburg—Air Reduction Sales Co.
Honolulu—Hawaiian Gas Products, Ltd.
Houston and throughout Texas—
Magnolia Airco Gas Products Co.
Huntington—Air Reduction Sales Co.
Indianapolis—Air Reduction Sales Co.
Jersey City—Air Reduction Sales Co.
Kansas City—Air Reduction Sales Co.
Lima—Air Reduction Sales Co.
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New Orleans—Air Reduction Sales Co.
New York—Air Reduction Sales Co.
Chicago Combustion Co.
Oklahoma City—Air Reduction Sales Co.
Omaha—The Balbach Co.
Fuchs Machinery & Supply Co.
Philadelphia—Air Reduction Sales Co.
Phoenix—Arizona Welding Equipment
Pittsburgh—Air Reduction Sales Co.
Williams & Co., Inc.
Portland—Air Reduction Sales Co.
Richmond—Air Reduction Sales Co.
Rochester—Air Reduction Sales Co.
Saginaw—Northern Supply
Savannah—Bay Welding Sup. Co.
St. Louis—Air Reduction Sales Co.
Steel Sales Co.
San Francisco—Air Reduction Sales Co.
Pitts & Loughlin
Seattle—Air Reduction Sales Co.
South Portland—Air Reduction Sales Co.
Shreveport—Air Reduction Sales Co.
Spokane—Gibson Welding Supply Co.
Toledo—Air Reduction Sales Co.
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Tulsa—Air Reduction Sales Co.
Vancouver, B.C.—Scott-Foster & Co.
Warren—Air Reduction Sales Co.
Wheeling—Air Reduction Sales Co.
Wichita—Air Reduction Sales Co.

"More Arc Time"
Martin Wells
ELECTRODE HOLDERS
Los Angeles 1, California

Beryllium-Copper Information

A six-page booklet describes the production of "Viculoy" beryllium-copper castings, the properties of these alloys and their various uses including arc-welding electrode jaws and resistance-welding tips and holders. **Akron Bronze & Aluminum Co.**, 579 Washington St., Akron, O.

» «

Spot-Welder Pamphlet

The "Adams" portable spot-welding gun is described in a four-page pamphlet, which cites such advantages as light weight, small size, inexpensive repair and maintenance, etc. **The Central Corp.**, 20 N. Wacker Drive, Chicago 6.

» «

Powdered Metal Process

A four-page, letterhead-size folder gives the details of a new method of welding, brazing or hard-facing with various compositions of powdered metals. The method makes use of the new "Powder Weld" torch, fully described in the folder. **Powder Weld Co.**, 419 Kent Ave., Brooklyn.

» «

Descaling Process Guide

The advantages and outstanding features of the DuPont sodium hydride descaling process are described in an eight-page, letterhead-size folder. **E. I. DuPont de Nemours & Co., Electrochemicals Department**, Wilmington 98, Delaware.

» «

Welding and Brazing Catalog

Catalog 1B brings full details and helpful data on carbon welding electrodes, plates, rods, paste resistance-welding tips and similar other products for industrial uses. Of particular interest are the recently developed carbon brazing tips treated with the Stackpole "F" treatment for minimizing oxidation. Tests proved that these carbons operated satisfactorily at temperatures above red heat, reduced dressing time by as much as two thirds and increased life up to five times that of untreated carbon. **Stackpole Carbon Co.**, St. Marys, Pa.

» «

Electrode Folder

A convenient pocket-size folder describes a complete postwar line of arc-welding electrodes. The folder covers procedures, physical properties of weld deposits, sizes available for each type of electrode, etc. **The Hobart Brothers Co.**, Troy, Ohio.

» «

"Fiberglas" Booklet

An 8½ by 11 in., two-color booklet tells the uses of "Fiberglas" fabrics in industry and includes actual samples of neoprene-coated and vinyl-coated cloths. This new product assists the welding field with coated Fiberglas curtains and hoses. **Owens-Corning Fiberglas Corp.**, Toledo 1.

» «

Cast-Iron Cutting Circular

A method for the successful and economical cutting of cast iron is explained in a newly published circular. It covers the correct types of equipment, preheating condition, cutting positions, adequate protective clothing, proper oxygen and acetylene pressures, etc. Ask for circular N-606, **The Technical Service Dept., National Cylinder Gas Co.**, 205 W. Wacker Drive, Chicago 6.

» «

Induction-Heating Catalog

A 36-page, letterhead-size catalog has been published to tell how the new induction-heating units are helping the metals industries to perform metal-heating jobs faster and better. The booklet discusses the principles and practical application of induction heating and gives pictures of the company's heating equipment in operation. **Lepel High Frequency Laboratories, Inc.**, 39 W. 60th St., New York City 23.

» «

Quonset Folders

Four attractive folders illustrate the advantages of "Stran-Steel" framing for the building of arch-rib, all-steel "Quonsets" for shops, garages, houses, stores, farms, etc. The framing members described in these folders provide a patented nailing groove in joists, arch ribs and purlins for attaching materials. **Great Lakes Steel Corp.**, Stran-Steel Div., Penobscot Bldg., Detroit 26.

» «

Flash-Welder Bulletin

An eight-page, two-color, technical bulletin describes the new Progressive line of standard flash welders. Phantom and detail views are given to show the numerous features of this line of flash welders from 20 to 250 kva. **Progressive Welder Co.**, 3050 E. Outer Drive, Detroit 12.

» «

Liftruck Folder

Two new additions in three colors have been added to the Revolvator loose-leaf catalog on liftrucks. One folder illustrates and describes the model G "Red Giant" hand liftruck and the other an improved portable elevator. **Revolvator Co.**, North Bergen, N. J.

» «

Meehanite Movie Folder

An 8½ x 3¾ in. folder gives the details of a new 16-mm movie produced to provide definite facts and figures about Meehanite castings and their applications. **Meehanite Metal Corp.**, Pershing Square Bldg., New Rochelle, N. Y.

Motor-Frame Bulletin

The application of welding to the manufacture of a-c and d-c motor frames is described in an interesting bulletin prepared by the **American Welding & Manufacturing Co.**, Warren, Ohio. The bulletin covers arc and flash welding of simple ring and complex specialized frame types, and enumerates the characteristics and economies obtainable.

» «

Rustless Steel Data

A 12-page booklet contains data on all types of "rustless" steels, giving the groups into which they are classified, comparison of properties, chemical analyses, mechanical and physical properties. The advantages of using stainless steels are discussed in detail. **Rustless Iron and Steel Corp.**, 3405 E. Chase St., Baltimore 13.

» «

"Vibra-Weld" Bulletin

A two-color letterhead-size bulletin describes the new "Vibra-Weld" machine and "pencil" weld gun, an outfit designed to permit the welding of ferrous and non-ferrous metals without heat distortion. The pencil weld gun welds one particle of metal at a time to the surface and then peens it by a vibrating action to assure a dense deposit. **Mid States Equipment Corp.**, Chicago.

» «

Welded Equipment Folder

An attractive eight-page, letterhead-size folder in two colors describes and illustrates the LeTourneau line of welded earth-moving equipment. Interesting pictures show the heavy machines such as "Carryalls," "Tiltdozers," "Rooters" and cranes in operation. **R. G. LeTourneau, Inc.**, Peoria, Ill.

» «

Ampco Metal Bulletin

Bulletin 72 describes the uses of Ampco metals for such purposes as resistance-welding electrodes, mill products, continuous cast bearing bronzes, clad metals, pumps and fabricated assemblies, non-sparking safety tools and arc-welding electrodes. Included is a chart giving such properties of the various Ampco metals as tensile strength, yield strength, elongation, Brinell and Rockwell hardness, etc. **Ampco Metal Inc.**, Milwaukee 4.

» «

Hydraulic Press Folder

A four-page two-color folder describes the standard line of model PA hydraulic assembly presses. In addition to specifications, dimensions, and a description of the standard line of presses, the bulletin includes illustrations of typical special hydraulic assembly presses. Bulletin PA-45, **Colonial Broach Co.**, Box 37, Harper Station, Detroit 13.

How to Find Pipe Capacity

By **W. F. SCHAPHORST, M.E.**

A WELDOR is frequently called upon to cut into a filled pipe. In these instances it is nice to know what size of container is needed to hold the contents that will drain from the pipe. This information can readily be obtained from the accompanying nomograph.

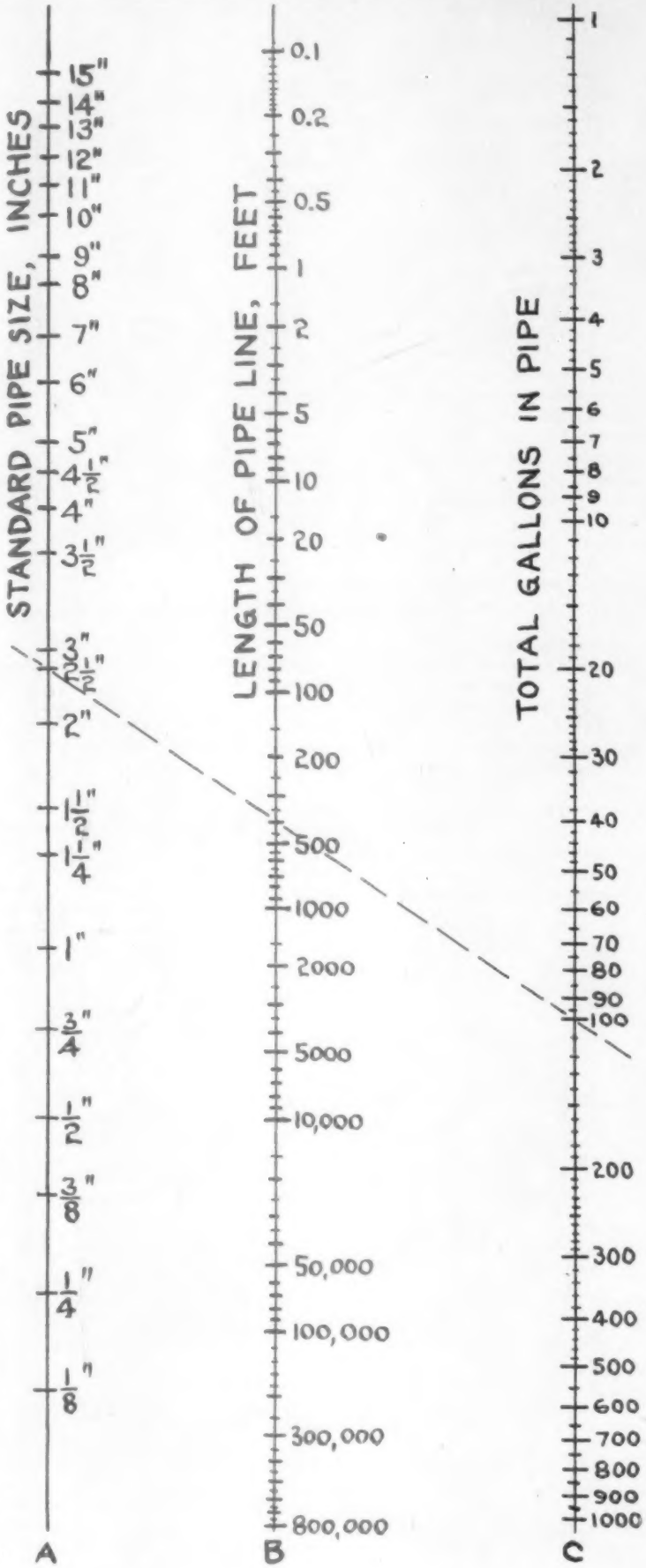
To use this nomograph, all that is necessary to know is the size of the pipe and the length of the pipe line. The quantity of fluid in the pipe may be determined by placing a straight-edge through the pipe line in column A and the length of the pipe line in column B. The intersection with column C immediately gives the total number of gallons in the pipe or pipe line.

In the accompanying example, it was desired to know how many gallons of fluid would be contained in a 2½-in. line, 400 ft long. The dotted line on the chart, which runs from 2½ in. (column A) through 400 ft (column B), indicates that there were 100 gallons (column C) in the line.

The nomograph will serve equally as well if it is desired to know the length of the pipe line which will hold a given number of gallons or the size of pipe necessary to hold a given number of gallons within certain limitations of length. If two factors in any two of the three columns are known, the unknown in the third column may be found quickly.

The possible applications of this nomograph are limited only by the user's ingenuity. For example:

To determine the volume of a ½-in. pipe, one foot long, the easiest way is to run a line through the ½ in., column A, and the 10,000 in column B. The intersection with column C says 160 gallons, but that, of course, is for a pipe line 10,000 ft. long. By merely pointing off four places to the left, we find that 0.016 gal will be the volume of a ½ in. pipe one foot long.



FROM THE PATENT OFFICE

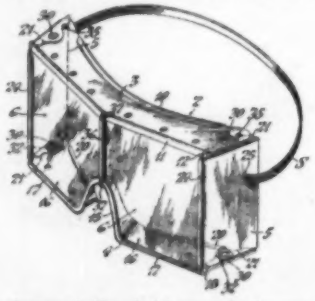
Method of Silver Cladding

2,392,917. **Edward Joseph Guinee,** Roselle, N. J., assigned to **The H. A. Wilson Co.,** Newark. Filed Jan. 26, 1944. Issued Jan. 15, 1946.

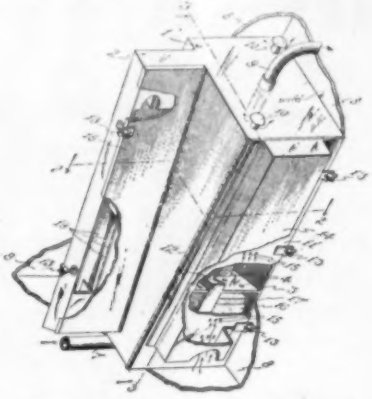
A method of welding silver to steel by forming a thin coating of copper on the surface of the steel by flowing molten copper thereon. The steel thus coated is heated at a temperature above the melting point of the copper but below the melting point of the steel until a substantial proportion of the copper has diffused into the steel and alloyed with it, leaving the balance of the copper on the surface. A solid piece of silver is then placed on the copper-coated surface to produce a copper-silver interface. The silver is welded to the steel in the absence of flux by pressing the silver against the copper coating and heating the assembly to a temperature in the neighborhood of but below the melting point of the silver. The heating is carried out until the balance of the copper has diffused substantially into the silver. This eliminates the copper-silver interface and produces a joint free of unalloyed copper. The silver is united directly to the steel surface, the amount of copper present on the surface of the steel at the beginning of the silver-welding step being negligibly small. The diffusion of the copper into the silver is limited to a space immediately adjacent the final steel-silver interface, and virtually none of the copper penetrates completely through the piece of silver.

Goggle

2,391,361. **Walter J. Stevenson,** Riverside, R. I. Assigned to **Watchemoket Optical Co.,** Providence, R. I. Filed Sept. 11, 1943. Issued Dec. 18, 1945.



A substantially rigid goggle frame comprising a longitudinally extending top member having its rearward edge of arcuate contour to fit the face of the wearer and a bottom member of the same form having its lateral wing portions connected by an arched bridge-portion of narrow width adapted to fit over the wearer's nose. Top and bottom portions are constructed of transparent plastic material with grooves at their forward edges for holding a pair of lenses extending in angular relation outwardly from the center of the frame. Rectangular side panels having hinge portions underly the top and bottom members of the frame and are pivotally connected thereto to connect the top and bottom members rigidly. The side panels are also constructed of transparent plastic material and have inwardly directed integral flanges adapted to extend vertically across the edges of the lenses to retain them in the frames. Hinges are so constructed as to permit the flanges on the side panels to be swung back to release the lenses.



Electrode Storage Cabinet

2,391,940. **George M. Beimer,** Rutherford, N. J., assigned to **Couse Laboratories,** Newark. Filed Nov. 24, 1943. Issued Jan. 1, 1946.

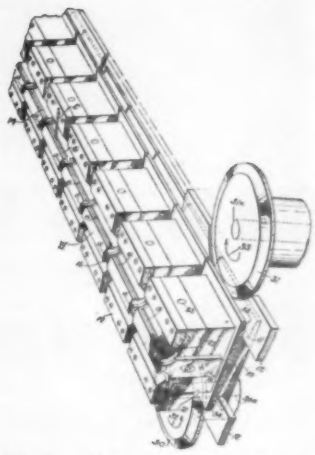
A cabinet for an engine-driven portable welding shop having two vertically spaced rows of shelf-type compartments to receive electrodes. The shelves have ventilation openings, and each compartment has its own door. At least the top and bottom doors are provided with air chambers to pass air into the compartments through the openings in the shelves. A heat-transferring chamber is centrally located between the rows of compartments and extends straight across the cabinet with its rear wall terminating in close proximity to the rear wall of the cabinet to form a small space chamber. Heat coming from the engine is passed to and from the heating chamber in order to keep the electrodes dry. The ventilation of the cabinet is assisted by transverse passages connecting the compartments on one side of the heating chamber with the corresponding compartments on the other side by way of the space chamber.

» «

Jig for Automatic Welding

2,391,762. **John Raymond Wirt,** Anderson, Ind., assigned to **General Motors Corp.,** Detroit. Filed Oct. 20, 1944. Issued Dec. 25, 1945.

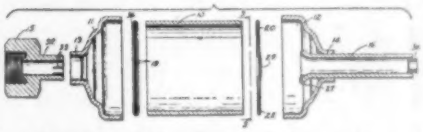
Means for moving work holders in end-to-end relation along a guiding track past an arc-welding electrode. Engaging the track is a workpiece support having means for securing the separate holders. A block of metal of high thermal and electrical conductivity is attached to the support and extends into the space between workpieces of adjacent holders when on the guiding track. A portion of this block adjacent to the end of the workpiece provides an arc-contacting surface spaced from the electrode at a distance greater than the gap between the electrode and the work.



» «

Screen-Brazing Method

2,392,886. **Henry D. Stecher,** Lakewood, and **Joseph Norman Paquin,** Euclid, O., assigned to **The Weatherhead Co.,** Cleveland. Filed Feb. 15, 1940. Issued Jan. 15, 1946.



A method of securing a fine-mesh metallic screen within an assembly to be copper brazed while preventing copper from reaching the screen. It includes the steps of: (1) binding the edges of the screen material with a chromium-plated strip of ferrous material, (2) removing the chromium plating from the peripheral portion of the ferrous material, (3) assembling the screen with another ferrous member having a portion engaging the peripheral portion, (4) supplying copper adjacent the contacting surfaces of the parts and (5) passing the assembly through a brazing furnace to fuse the copper and form a bond between the peripheral edge and the adjacent ferrous parts.

The chromium plating prevents the molten copper from flowing over the ferrous binding and onto the screen during the brazing operation.

» «

Weldor's Mask

2,391,565. **Thomas H. Grindrod** and **Arthur E. Church,** Portland, Ore. Filed March 14, 1944. Issued Dec. 25, 1945.

A device consisting of a nose piece adapted to cover the nose and mouth of the wearer. The edges contacting the cheeks are fluted to permit the outward flow of air therethrough. There is also a means of injecting fresh air along the front of the nose piece and discharging it outwardly in both directions toward the cheek-engaging edges.

(Please turn to page 100)

News of the Industry

U-235 May Bring New Industrial Techniques

The utilization of atomic power on a broad scale may be just around the corner or may require years of arduous labor. More immediately important to industry, according to the M. W. Kellogg Co., New York City, is the wealth of technical knowledge that exists as a result of advances gained in the separation of U-235 from natural uranium. Practically all branches of industry, including welding, stand to benefit from an application of several new procedures developed by the Kellex-engineered diffusion plant at Oak Ridge during the last three years. All efforts were directed towards more efficient processing with its attendant results of higher quality and lower costs.

The principle behind the separation of U-235 from natural uranium is to convert the solid metal into a gas and to make use of the difference in velocities of the two isotopes by diffusion through a porous barrier. After passing through several thousand such stages, an appreciable concentration of U-235 can be effected. To put this theory into commercial operation, however, involved the design, engineering and production of new equipment plus new materials to be overcome.

The benefits derived are numerous for industries using corrosive chemicals: new valve and pump lubricants, induction-operated pumps and a new treatment of metal surfaces. Petroleum refining will profit by improved pumping, new-type heat exchangers and improved analytical and automatic control. New methods of checking welds, pretesting vessels for leaks and improved vacuum techniques should interest manufacturers of pressure vessels. Gas-processing applications include new techniques for the separation of helium, hydrogen, oxygen and rare gases from air and advances in recycling.

A full-scale improved type of mass spectrograph should greatly aid the petroleum industry in the continuous control of cracking operations and transfer line analysis. Some of its potential uses in industry include continuous automatic control of gaseous processes such as alkylation, vapor phase cracking, the checking of inert gases such as nitrogen used to provide a protective atmosphere in furnaces, and the detection of impurities in supposedly pure gases.

One of the most important developments is a leak detector of excessive sensitivity. It is well adapted for the location of microscopic leaks that were formerly undetectable. Other potential uses include pretesting of pressure and vacuum apparatus, and the testing of welds for minute pores which even X-rays have not been able to reveal. The detector would also enter the refrigeration field to guard against leakage of refrigerant.

In addition to these many developments, the atomic-bomb project will soon make available to the medical profession and to industry an abundant and cheaper source of radioactive materials.

» «

Arcos to Act as Own Distributor

Field engineers of the Arcos Corp., Philadelphia, will serve the Atlantic coast, including New Jersey, eastern New York and New England, from the company's Philadelphia office at 1515 Locust St., Philadelphia. This territory was formerly served by the distributing firm of H. Boker & Co.

» «

Victor Equipment Opens Retail Store

A new retail sales store for gas and electric welding apparatus and supplies has been opened in San Francisco by the Victor Equipment Co. The store is located adjacent the company's main office and manufacturing plant on Folsom street, in a newly acquired building which provides over ten thousand square feet of additional floor space.

Greatly enlarged shipping facilities are located on the ground floor and large quarters for the company's technical publications and advertising department are on the second floor of the new building. A modern research and testing laboratory will occupy the third floor.

Sales counter displaying pieces of welding and cutting apparatus and accessory items in the new Victor Equipment Co. retail sales store.

Lincoln Celebrates 50th Anniversary

Marking the company's 50th year in the welding field, an anniversary dinner for 1,100 employees of the Lincoln Electric Co., was held last month in the Hotel Cleveland. Presiding over the banquet, President James F. Lincoln praised his workers for their contributions to the success of the business. He pointed out that through a "unique experiment" in management and labor relations, the products of the company had been reduced 60% in price during the past decade and a half. In the same length of time, production and wages more than quadrupled.

Mr. Lincoln presented several of his employees with gold pins for long-time service with the firm. Among these were Joseph Satava, Jr., welding inspector, who has been with the company for 35 years, and Earl J. Reed, president of the company's employee's association, who was awarded a 30 year pin. Thirteen other employees received pins for 25 years of service.

» «

International Nickel Forms Canadian Research Section

International Nickel Co. of Canada, Ltd., has formed a new development and research section at 25 King St. West, Toronto, Canada. The function of this department will be to extend to Canadian industry a complete consulting and technical service on metal problems. The section will be allied with comparable research sections in the United States and British divisions.

The section will be staffed by some of the topmost men in the fields of mechanical and metallurgical engineering. These include: Gordon S. Farnham, recently chief metallurgist for the department of mines, Ottawa; A. S. Tuttle, who was for three years with the engineering department of Canadian Westinghouse and more recently with the Metals Control, Ottawa; and Major Butterill, until recently, chief design officer on light anti-aircraft guns and rockets, The British Ministry of Supply.

» «

Silver for Copper— $100,000,000 Worth

Allis-Chalmers Mfg. Co., Milwaukee, has just reported that $100,000,000 worth of silver was used as a substitute for scarce copper in the construction of atomic-bomb machinery. Permission was granted by the U. S. Treasury Department to ship the silver from the Treasury's Fort Knox, Ky., cache. The silver was shipped in belt-like straps about two inches wide; the route taken varied with each trip and the cargoes were guarded by special treasury agents. Treasury men also saw to it that silver sawdust in the shops was accounted for to the last fraction of an ounce. Altogether, the silver used weighed 12,000,000 lb.

. . . PRECISION CONTROL OF **HEAT!**

Precision control of Preheating for Welding and Normalizing after welding is the only efficient method for joining modern alloy steels. Induction Heating by the Smith-Dolan System, PLUS the new Heat-Cycle Program Control gives all this — and more!

MODERN—SELF-OPERATING—COMPLETE!

Once the metallurgical heat-cycle for the steel has been determined, it is only necessary to set the controls, and the machine shown above will deliver this program from start to finish! In addition, recorded charts keep permanent records for duplication of results. A complete unit for efficient performance. Temperatures up to 1750° F. readily obtainable.

ELECTRIC ARC, Inc.

152-158 Jelliff Ave. Newark 8, New Jersey

Resistance-Welder Corp. New Member in Its Field

Several well known individuals in the resistance-welding field have joined forces to organize a new company known as The Resistance Welder Corp., Bay City, Mich. J. R. Brueckner, formerly vice-president of National Welding Machine Co., is president, L. E. Nichols vice-president, C. F. Kaunitz vice-president, F. C. Learman treasurer, and L. W. Bartlett secretary.

The company has established a Detroit office at 6-255 General Motors Building from which sales are directed. It plans to manufacture a complete line of spot, projection, seam and flash welders. It will also design special resistance welders for the automotive, refrigeration and household appliance fields.

» «

Bright Future Foreseen for Resistance Welding

"Perhaps no single tool of fabrication has contributed more to America's increased productivity than electronically controlled resistance welding," E. H. Alexander, engineer, control division, General Electric Co., declared in a recent address. Today, he pointed out, air-hardenable steels are being joined by resistance welding, annealed and then tempered in one continuous sequence of precision-controlled events.

"It isn't careless to predict," said Mr. Alexander, "that in the future the fabrication of large steel buildings and ships will be by this method. And because of electronics every joint will 'write' on a permanent record its own certification of strength. An electronic weld recorder will do the job."

New Distributors

Metal & Thermit Corp., New York City 5: (Distributors for the complete line of Murex electrodes) Hill Equipment Engineering Co., St. Louis; Mid-County Supply Co., Stephenson, Mich., Johnson Service & Supply, Little Falls, Minn.; J. T. Shelton & Son, Odessa, Tex.; Welding and Industrial Products, Ltd., Honolulu, T. H.; José Cestero, Jr., Puerto Rico.

» «

Precision Welder and Machine Co., Cincinnati: The Weber-Semmer Co., 5108 Liberty Ave., Pittsburgh 24.

» «

Wilson Products, Inc., Reading, Pa.: Allied Safety Equipment Co., 314 M. & M. Bldg., Houston 2, Texas, Casper Supply Co., P. O. Box 660, Casper, Wyoming, J. E. Haseltine & Co., 2nd Ave. and Ash St., Portland 4, Oregon, Hendrie & Bolthoff Mfg. & Supply Co., 1639 Seventeenth St., Denver, Colorado, Industrial Supply Co., Inc., 121-135 Motor Ave., P. O. Box 600, Salt Lake City 9, Utah, Montana Hardware Co., 823 So. Montana St., P. O. Box 1944, Butte, Montana.

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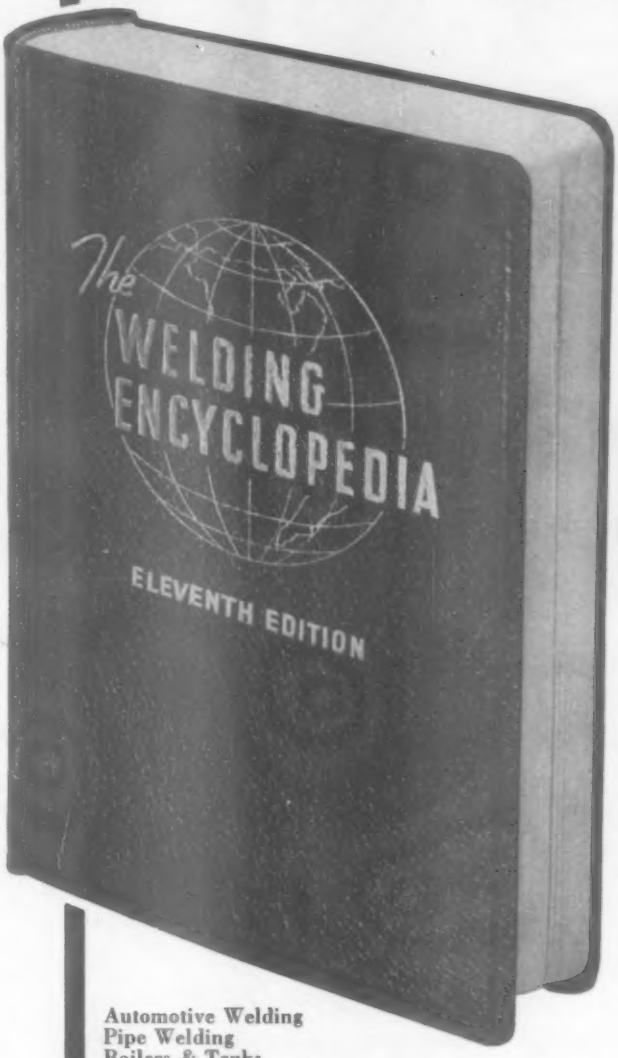

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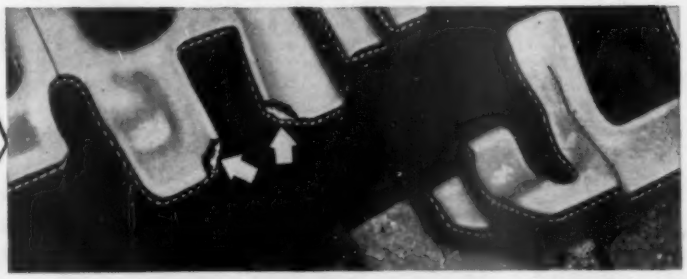
Quickly repair damaged dies ... by WELDING

HOW TIME IS SAVED



You realize huge savings when you repair damaged dies by welding because you *confine actual repairs to the immediate faulty areas only.* Dotted line in the illustration above indicates the ordinary time-consuming method of repair which necessitates reworking the entire area. You can repair virtually all types of tool steel by using the proper Eureka Tool Steel Welding Electrode. You can salvage or reclaim die units used for blanking, forming, forging, drawing, embossing, etc., etc.

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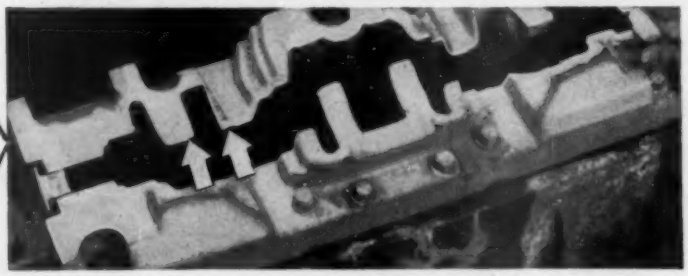

Weld deposits of Eureka Tool Steel Electrodes are, in most cases, "hard-as-welded," and subsequent heat treatment, other than tempering, is not necessary if the units lend themselves to grinding. Metallic arc welding with Eureka Tool Steel Electrodes retains dimensions within close limits. WRITE today *for your free copy of our 40-page Tool Steel Welding Manual, which graphically illustrates how welding can save you valuable man hours through repairing dies, composite fabricating, correcting design or rectifying errors.*

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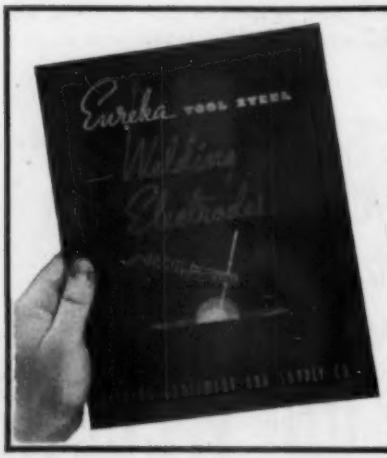

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New Firm Will Enter R-W Electrode Field

Joseph A. Weiger, former vice-president of P. R. Mallory & Co., Indianapolis, and Henry D. Weed, Jr., formerly manager of the resistance alloy division of the same company, have formed the new manufacturing firm of Weiger-Weed to specialize in resistance-welding electrodes, electrical contacts and special metallurgical products. Headquarters, office and production facilities will be at 11644 Cloverdale Ave., Detroit.

Mr. Weiger became head of metallurgical engineering for the Mallory company in 1925 and later was made vice-president and manager of metallurgical activities. During the war he was in charge of Mallory production.

Mr. Weed became associated with the Detroit office of the Mallory Company in 1940. In 1942 he was assigned to the Indianapolis plant as sales head of the resistance-welding division.

» «

Optical Aid Offered to Industrial Workers

A vision-checking program designed to promote industrial efficiency and safety by spotting those employees who need eye correction is being sponsored by American Optical Co., Southbridge, Massachusetts.

Surveys disclose that one out of every three industrial workers is handicapped by deficient vision, costing American industry millions of dollars. The new program is aimed to reduce this grave loss. Detection of the visually unfit will be accomplished with the aid of the AO "Sight Screener," a new portable instrument. Data on 14 visual functions can be obtained in a few minutes with this device.

» «

Machinery and Welder Corp. Opens Twin City Branch

Machinery and Welder Corp., Chicago, has opened a new Twin City branch at 2440 Second Avenue North, Minneapolis 11. The new branch will carry a complete line of welding equipment and accessories, including General Electric and Meco equipment as well as General Electric, Arcos and Ampco welding electrodes.

» «

New Plant to Handle Rods and Accessories

Standard Electrode and Mfg. Corp. has opened a new Twin City branch at St., Philadelphia 44. The plant will handle a complete line of welding rods and accessories.

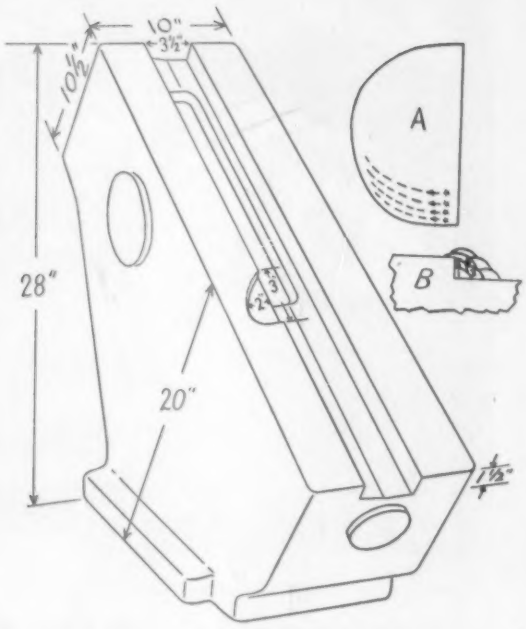
» «

Tradename Change

The Safety Clothing & Equipment Co., Cleveland, has adopted the tradename "Gardwell" for its products. All types of welding clothing are included.

No hard spots—no warping—no preheating cost—when this 500-lb. iron casting was welded with

PHILLIPS "600" Electrode



EVERY working day of the year hundreds of plants and foundries use PHILLIPS "600" Electrode to salvage damaged, worn and defective gray iron castings which would otherwise be scrapped. The castings thus reclaimed are fully machinable because deposits of PHILLIPS "600" Electrode develop no hard spots, even at the line of fusion. After machining the weld is practically invisible, because deposits of this electrode are of the color of cast iron.

Proper application of PHILLIPS "600" Electrode will greatly reduce your maintenance costs and scrap losses. Full information on correct procedures is available through Phillips distributors located in all principal cities. Write us if you would like to have a representative call to discuss the salvage of your gray iron castings.

To fill a notch which had been machined in this 500-lb. iron casting, a special procedure was adopted due to the inclined position of the work. Starting about ⅛" from the edge, successive beads of PHILLIPS "600" were deposited in the direction shown at A. Deposit sequence is shown at B. When the casting was warm enough to prevent chilling, final deposits were made around the edges. The arc was always held on the previous deposit when working along the edge, never on the sharp corner of the casting. No preheating was necessary. Welding time was about 45 minutes. No hard spots were encountered in machining.

Our "4 Ways" book is a manual of procedures for various applications of metallic arc welding to gray iron castings. Send for your copy TODAY.

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"EITHEREND" CABLE CONNECTOR

Illustration shows connector apart with sleeves

BOTH ENDS EXACTLY ALIKE

Neither male nor female

Center illustration shows connector protected by the insulating sleeves pushed together and locked, ready for work: butt rubber sleeves make waterproof joint.

Lower illustration shows solderless type of connector without rubber sleeves. Made in sizes from 4/0 to #10 soldered and from 4/0 to #6 solderless.

Send for Bulletin 49A

Albert & J. M. Anderson Mfg. Co.

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NEW YORK CHICAGO PHILADELPHIA LONDON

New Research Program on Pressure Vessels

A pressure vessel research program covering materials, design, fabrication, inspection and testing of unfired pressure vessels has been started by the Welding Research Council. The program is sponsored by the American Welding Society, American Society of Mechanical Engineers, American Institute of Electrical Engineers and other engineering societies.

This program has been initiated to answer the need for quantitative data by those engaged in pressure-vessel design and construction. The lack of factual information has resulted in acknowledged over-conservatism in designs.

At the first meeting of the new committee, the employment was authorized of a full-time New York headquarters secretary to collect and maintain adequate records and to correlate the projects approved with the research facilities and personnel of selected university laboratories. Candidates for this position are requested to communicate with W. Spraragen, director, Welding Research Council, 29 W. 39th St., New York City 18.

» «

Chicago Production Show Scheduled March 20 to 22

The Chicago Production Show to be held in the Exhibition Hall of the Stevens Hotel, Chicago, March 20, 21 and 22, concurrently with the council's annual conference, is predicted to be a sellout. "Production for Profit" will be the theme of both conference and exhibition.

Emphasis will be on new advances in all departments of industrial production, tools, materials, instruments, and miscellaneous equipment. More than one hundred firms will take exhibit space. Among manufacturers who will represent the welding field are: Eutectic Welding Alloys, Inc., Salkover Metal Processing, Whiting Corp., Allis-Chalmers Mfg. Co., Taylor-Winfield Corp., Raytheon Mfg. Co., Canadian Radium and Uranium Corp.

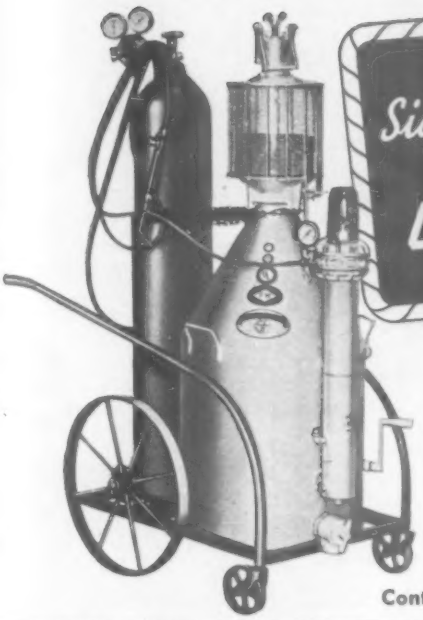
Free tickets of admission to the show may be obtained by any manufacturer on application to the Council headquarters at 53 W. Jackson Blvd., Chicago, or to any of the 47 participating societies including the American Welding Society.

Forty-eight panel sessions will comprise the conference. The speakers will include nationally known authorities in nearly every field of science and technology. This three-day conference is expected to give sharp impetus to reconversion in Chicago and the Middle West.

» «

New Building Leased By Smith Bros. Welding

Roy and Orville Smith of the Smith Bros. Welding Co., located at 490 W. Goodale St., Columbus, O., have taken a lease on a new building now being erected. After May 1 their business will be conducted at 1037 Parsons Ave., Columbus.



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● If the cost of carbide per 100 lb. drum is $5.10, the cost of the Sight Feed Acetylene per 100 cubic feet is $1.07. Compare this with the price you are now paying for acetylene.

Sight Feed keeps you from running out of acetylene and losing heat in the middle of a job —you see the carbide charge in the hopper and you know you have enough before you start.

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HERCO VARIABLE CORE ARC WELDERS

MODELS FROM 150 TO 1500 AMPERES WITH OR WITHOUT POWER FACTOR CORRECTION

for:

24 hour per day operation.
Exact heat control.
Increased production.
Lower power costs.
X-ray test welding.
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Inquire about MAGNETIC CLAMPS for quick positioning and alignment.

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MANUFACTURERS OF THE PRECISION WELDER WITH THE

STREAMLINED ARC

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Tool Engineers Society to Stage Exposition

The fifth exposition to be sponsored by the American Society of Tool Engineers will open at the Cleveland Public Auditorium, April 8 to 12. It will cover a wide range of products of interest to production engineers, including many items representing wartime developments not previously displayed to the industrial public.

Technical sessions, motion pictures and visits to a number of plants in Cleveland and vicinity will round out the exposition.

» «

COMING APRIL

THE WELDING ENGINEER

ANNUAL DIRECTORY OF

WELDING EQUIPMENT

Brake Shoe Purchases Joliette Steel Ltd.

American Brake Shoe Co., New York City, has purchased Joliette Steel Limited, one of the largest producers of manganese and alloy steel castings in Canada. The company will be operated by the present management, working under the direction of Brake Shoe's manganese steel division. Many products such as manganese dredge buckets, dippers, frogs and switches, crusher parts and mill liners will now be manufactured in Canada.

» «

RWMA Elects New Officers

H. B. Warner, executive vice-president, Thomson-Gibb Electric Welding Co., Lynn, Mass., was elected president of the Resistance Welder Manufacturers' Association at its regular annual meeting Jan. 24. G. N. Sieger, president and general manager of S-M-S Corp., Detroit, was elected vice-president; George A. Fernley, Philadelphia, executive secretary, and H. R. Rinehart, Philadelphia, secretary-treasurer.

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has done it again!

● These Four New Marquette Welders are the latest Marquette achievement. Note a few of the advanced features. Model 262 C has built-in capacitor for high power factor. Telnic Bronze (new copper-nickel alloy) plugs and sockets doubles current carrying capacity. Newly designed transformer gives improved welding characteristics and Instant arc striking without high frequency or booster gadgets. Front panel designed for greater convenience. New aluminum alloy construction reduces eddy current losses and increases transformer efficiency. Ranges: Model 261 and 261 C, 20-200 amps.; Model 262 and 262 C, 20-275 amps. All Marquette Welders are Fully Equipped.

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MARQUETTE MFG. CO. INC.

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ABOUT PEOPLE

R. H. Munn, Jr. has been appointed manager of the Pittsburgh office of Ampco Metal, Inc., Milwaukee, and will act as field engineer in the new territory. Mr. Munn was Pittsburgh representative in 1940 prior to active duty in the Chemical Warfare section of the U. S. Army.

» «

J. A. O'Brien, vice-president of Johns-Manville Sales Corp., has been appointed manager of the power products and industrial department.

» «

Earl Severson, formerly with the Ford parts and accessories division, will head a new industrial and marine division to handle sales of Ford engines and parts to users in the industrial and marine fields.

» «

Jack Ellsworth will be in charge of the new Tube Turns, Inc., office in Detroit. He will represent the company's forging and welding fittings division and his territories will include northeastern Ohio, northern Illinois and Indiana.

» «

R. H. Burks, formerly with Goodman Manufacturing Co., and more recently with the U. S. Navy, is now fabrication superintendent of the Cleaver Brooks Co., Milwaukee, makers of packaged boilers and steam generators.

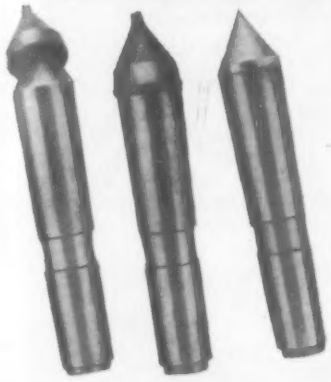
» «

R. G. Alison has been appointed sales manager of the welding division of the Lincoln Electric Co. of Canada Limited. Mr. Alison has been with the company for nine years, joining Lincoln after his graduation from the University of Toronto. He has had a wide experience in arc welding.

YOUR WORN
TOOL STEEL CENTERS
Can be Salvaged by using

COLMONOY

TIPPING SERVICE



● New tip castings of Colmonoy No. 6 can now be applied to your centers by using Silver Solder or a low temperature brazing alloy. Will outlast and outwear new, untipped centers.

We will apply for you, or furnish tips only. Moderate prices. Write for Bulletin CT-1 for complete information.

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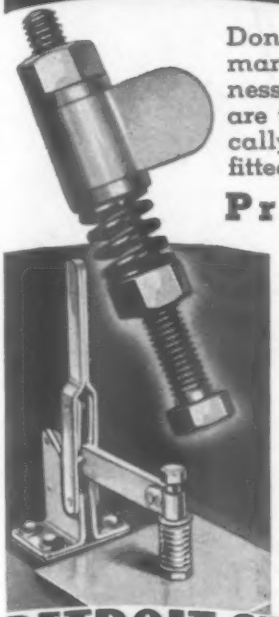
For CLAMPING PARTS *of* Varying *Thicknesses*



Don't waste time making manual adjustments; thickness variations up to ¼-inch are taken care of automatically when your clamp is fitted with a

Pressure-Matic Assembly

By means of a heavy compression die spring, the hold-down spindle automatically adjusts itself to the thickness of work or part being held, maintaining positive pressure. Assembly is welded to work bar. Types for medium and heavy duty De-Sta-Co Clamps.

Described in De - Sta - Co Clamp Catalog No. 45. Send for a Copy.

DETROIT STAMPING CO.
Established Over 30 Years
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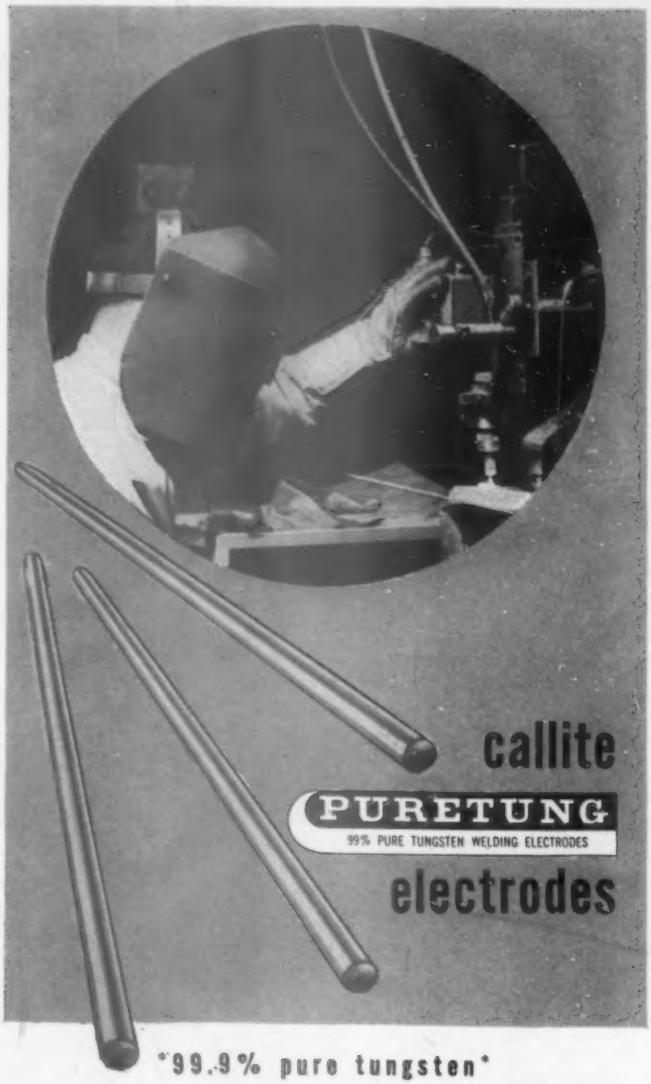

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speed fusion argon arc welding of aluminum
at GOODYEAR AIRCRAFT

In the fusion welding of aluminum aircraft radio containers, this Goodyear Aircraft welder is using Callite "Puretung" Electrodes in the argon arc welding process on an h-f, a-c automatic machine. Tops are welded to the lower section of the aluminum box while the latter slowly revolves. Here a smooth, bright surface and accurate control of the weld deposit is achieved by the use of Callite "Puretung's"

Of 99.9% tungsten, Callite Puretung Electrodes resist the extreme heat of the arc in atomic hydrogen, helium or argon welding. Puretung's retain their stiffness — keep the arc properly spaced — are consumed *slowly*. Puretungs insure unusually ductile, smooth, strong welds, requiring little machining and grinding. They are not only efficient, but economical, to use. Write for our Bulletin 154, describing various applications or check our engineers for specific information. Callite Tungsten Corporation, 549 Thirty-ninth St., Union City, N. J. Branch Offices: Chicago, Cleveland.

CT Callite PURETUNG ELECTRODES

Standard or special-polished, clean and black. 7 standard diameters, 12-inch lengths; random lengths and other diameters on special order.

OVER 26 YEARS PIONEERS IN TUNGSTEN METALLURGY.

Reid B. Gray has been appointed director of the Reynolds Research Institute, subsidiary of the Reynolds Metals Co. He succeeds **Dr. Warren J. Mead,** who has resigned. Mr. Gray will direct the Research Institute located in Long Island, and Richmond. Some of his contributions to science include bullet-sealing collapsible gasoline tanks, synthetic cement for sealing structures and a new furnace for melting zinc.

» «

Lt. Col. George M. Enos, recently released from the Cincinnati Ordnance District, has become professor of metallurgical engineering at the University of Purdue.

George A. Fisher, Jr. will direct the new St. Louis technical section of The International Nickel Co., Inc. The territory will include Missouri, southern half of Illinois, southwestern section of Iowa, northern half of Arkansas, western portion of Tennessee and Nebraska and Kansas. Mr. Fisher joined the Development and Research Division of the company in 1945.

» «

Frank D. Newbury, a vice-president of the Westinghouse Electric Corp., has been elected a member of the company's board of directors. Mr. Newbury is an authority on the design and construction of a-c electrical machinery.

• From spindle to grip, SKILSANDERS are better-built to take it on toughest bead grinding jobs, snagging castings or driving wire brushes . . . *at top load speed.* Extra capacity motors, high grade ball bearings, heat treated gears assure smoother operation, longer life. And the specially sealed dust-proof brush and commutator compartment is further assurance of longer, trouble-free life and lower operating cost per year. Ask your distributor today for a demonstration.

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Factory Branches in All Principal Cities

PORTABLE ELECTRIC
SKILTOOLS
MADE BY SKILSAW, INC.

PLANNING RETOOLING?

Let SKILTOOL Field Engineers help you now to plan "tooling-up" for more efficient and economical peacetime production with SKILSAW'S new postwar tools.

Robert S. Aitchison has rejoined the Lindberg Engineering Co., Chicago, to take charge of the advertising department. Prior to his entry into the Navy, he handled sales promotion for Lindberg and also directed production of the "Heat Treating Hints" movies produced by this concern.

» «

Fred E. Harrell, general works manager of the Reliance Electric & Engineering Co., Cleveland, has been elected a member of the board of directors. Mr. Harrell has been with Reliance since 1924, serving in the capacities of chief engineer and director of the company's Marine Division plant.

» «

Charles G. Boone, superintendent of the Pennsylvania Salt Mfg. Co. plant, has announced his retirement after 21 years as head of the company's Natrona operations. Mr. Boone became superintendent of the Natrona plant in 1925.

» «

George V. Slottman will head the new technical sales division of Air Reduction Co. Mr. Slottman holds degrees from the Massachusetts Institute of Technology and from the University of Berlin. He has done a great deal of work in the theory and application of gaseous combustion in steel mill operations in the United States and abroad. As manager of the new division, he will be assisted by **S. D. Baumer** and **E. V. David,** who have been assistant managers of the applied engineering department.

» «

John Armour Porter, formerly commander of the United States Naval Reserve and more recently with Pan American Airways, has become associated with Armour's Pattern Shop Co., Worcester, Mass., which specializes in automatic shape cutting and arc-welded jigs and fixtures. Mr. Porter will be vice-president and clerk of the corporation and a member of the board of directors.

» «

O. P. Donohue has been promoted to the sales promotion staff of the Allis-Chalmers Mfg. Co. He will specialize in the heating, ventilating and air-conditioning industries. **Arno A. Schubert** has joined the company and will engage in sales promotion of the machine tool industries.

» «

Stewart E. Lauer, president of York Corp., York, Pa., has completed 30 years as a member of The American Society of Refrigerating Engineers and thus becomes a life member of the Society.

» «

H. S. Rawdon has retired as chief of the division of metallurgy, National Bureau of Standards. Although the majority of his time will be spent in the country, he will represent the Bureau on a number of technical committees.

FOR YOUR HEAVY DUTY WELDING

NEW ERGOLYTE 300 STEPLESS TYPE WELDER

Be equipped to meet the toughest of 24 hour production schedules with this efficient, quick-arc A C model 300 welder. You'll find this machine lives up to its established reputation for speed, ruggedness, high capacity and low cost. Features include heat setting crank, Whirlwind air cooling system, power factor correction. Be equipped to do the best welding. Write for details.

Our 251 and 161 ampere welders are equipped with PLUS FEATURES for your needs. Write today for details.

We're seeking additional Jobbers NOW. Write Today.

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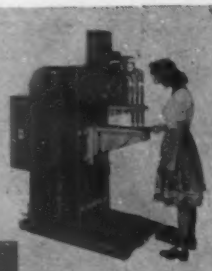

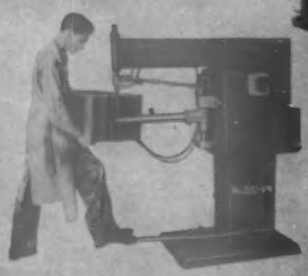

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We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

Transformers of all types.

We invite contract spot welding in large or small quantities.

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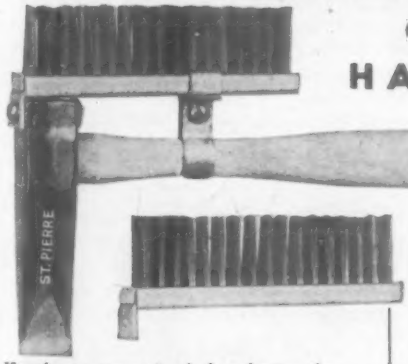
Address: 749 So. 13th St., (near Avon Ave.), Newark 3, N. J.

ABUSE MEANS NOTHING TO ST. PIERRE

CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

Breaks the Scale Cleans the Surface in One Operation

Order Today From Your Jobber or Direct

ST. PIERRE Chain Corporation
WORCESTER DROP FORGINGS MASSACHUSETTS

Fuse-Well Cast Welding Rods

The Standard of **QUALITY** **THROUGHOUT THE WORLD**

Cast Aluminum Welding Rods of Standard Analysis

Plain and alloyed Gray Iron Welding Rods and Electrodes

THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
346 ENGINEERING BUILDING
NORTH CHICAGO, ILLINOIS

Albert E. Zeisel, former midwestern regional sales manager for Eutetic Welding Alloys Co., has been appointed assistant in charge of sales for the entire company to R. D. Wasserman, founder and president.

» «

Melvin C. Shaw has been named manager of the blower and compressor department at the Allis Chalmers Mfg. Co., Milwaukee. He succeeds **John Avery,** who has resigned to become president of a blower corporation in Indiana.

» «

Philip R. Mallory has been elected chairman of the board of directors and **Joseph E. Cain** president of P. R. Mallory & Co., Inc., Indianapolis. Mr. Cain has been associated with the company for 18 years, serving as credit manager, treasurer, vice-president and executive vice-president.

Vernon W. Sherman has organized the Sherman Industrial Electronics Co., in Belleville, N. J., a new firm specializing in electronic heating. He formerly managed the industrial electronics division of the Federal Telephone and Radio Corp.

» «

Mars G. Fontana has accepted a professorship in metallurgy at Ohio State University and has also been appointed to the research professorship at the University's engineering experiment station.

» «

Jack Farris, formerly with Saginaw Welding Supply Co., has formed the Jackson Welding Supply Co., with offices at 408 No. Chevrolet, Flint, Mich. The company will handle welding apparatus, accessories and safety equipment, representing Victor Equipment Co., Dockson Corp., Jackson Products, Sight Feed Generator Co., Glenn-Roberts Co. and Metal & Thermit Corp. **Tork Reynolds,** formerly salesman with Fisher Body Grand Blank tank plant, is now with Mr. Farris as a salesman.

» «

Joseph A. Small has been appointed assistant sales manager of the Ryan Aeronautical Company's exhaust manifold department. In his new position, he will assist in further development of new business for the company's large-scale exhaust systems production activities.

» «

Earle A. Seares has been appointed western representative for Wilson Products, Inc., Reading, Pa. His headquarters will be at 1635 Seventeenth St., Denver 17, Colorado.

» «

H. W. Hartman has been named works superintendent in the Cleveland mills of the American Steel & Wire Co., U. S. Steel subsidiary. He was first employed in 1922 holding various jobs in the operating department before becoming general foreman of the straight & cut & cold finished bar department in 1936. Mr. Hartman became superintendent at Newburgh Wire Works in 1945.

» «

J. E. Brown will succeed Mr. Hartman as superintendent of the Newburgh Works. He has held various positions at that mill and became general foreman in 1937. Mr. Brown leaves the position of assistant of the wire and finishing committee in the industrial engineering department to take up his new job.

R. W. Nelson has been appointed sales representative for Machinery and Welder Corp., Chicago. He will serve industrial areas around Green Bay, Wis. **J. H. Holsin,** another new representative, will serve Rockford, Ill.

» «

R. O. Meyer has joined the sales staff of Saginaw Welding Supply Co., Saginaw, Mich. He will cover the southern territory, which includes Flint and Lansing. Mr. Meyer was formerly associated with the Miles Machinery Co., Saginaw.

» «

E. Dale Trout has been appointed director of an expanded technical services department to coordinate all types of technical advisory services for General Electric X-Ray Corp., Chicago.

» «

F. B. Jacob has been appointed sales manager of Thomson-Gibb Electric Welding Co., Lynn, Mass. Mr. Jacob has represented the company for many years in Cleveland and California. **H. W. Stieglitz** will be assistant sales manager to Mr. Jacob. Mr. Stieglitz has had ten years of experience with Thomson organization plus considerable time with both Fisher Body Corp. and Chrysler Corp. as a welding engineer.

"NAW - I always let the other guy try anything new!"

Bare-rod Benny up there is mighty skeptical about "new" equipment and methods. So he lets his fellow workers do the trying—and wonders why they also do the business.

Long ago we talked G-R a.c. welders to Benny. When we showed him how easy a G-R handled overhead and vertical welds, he said it couldn't be done with a.c. When we had him clock a weld, and proved that G-R gave him increased welding speed of 30% or more, he claimed we faked it. And when we showed him how the G-R saved power, he labeled us plain liars.

Benny took a war job, and saw scores of G-R's at work. They did everything we said, and more. Now he wants a G-R—but a used one! When we told him about G-R's many improvements, like power-factor correction and Volt-O-Matic Control, he gave us the same old line: "I always let the other guy try anything new!" It's easy to keep a man like Benny down . . !

- **Modern G-R welders are on display at your nearby G-R distributor. He will gladly demonstrate the *right* G-R (models range from 100 to 2,500 amps, rated capacity). See him soon, or write us for literature.**

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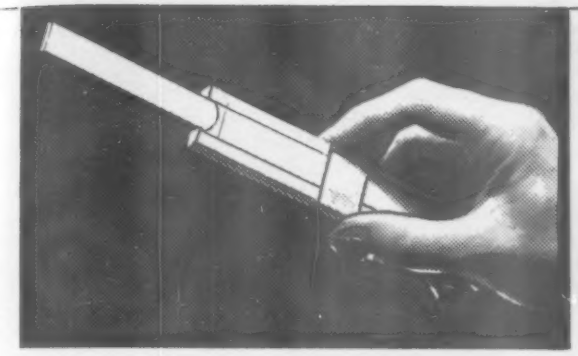
2107 ADAMS STREET • INDIANAPOLIS 1, INDIANA



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THE TIME AND MONEY

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NO-SPAT saves TIME, MONEY and LABOR because it prevents spatter from adhering to metal surfaces, eliminates long, costly, old-fashioned cleaning. It helps keep welding jigs clean, maintains maximum welding strength. Reduces fumes 30%; does NOT produce carbon monoxide. NO-SPAT is inexpensive, ready to use. No mixing required. Just apply and start welding at once.

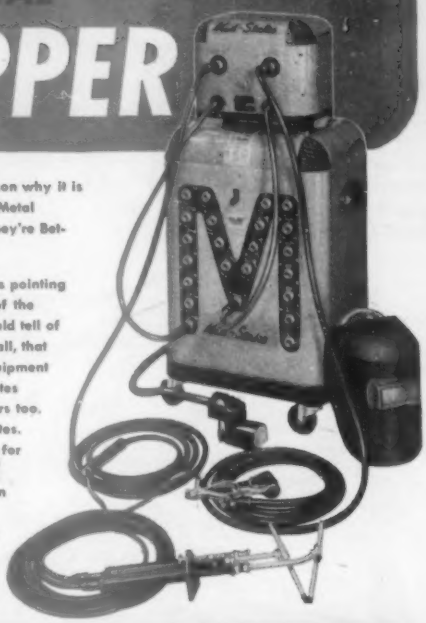
Write for FREE SAMPLE and detailed engineering test bulletin.

THE MIDLAND PAINT & VARNISH CO.

9110 Reno Avenue — Cleveland 5, Ohio

It's just good business

TO OWN A METAL ZIPPER



● There is a very good reason why it is good business to own a Metal ZIPPER Arc Welder . . . "They're Better"—that's all!

● We could go on for pages pointing out the superior features of the Metal ZIPPER. And we could tell of many shops, large and small, that have discarded inferior equipment to standardize on Mid-States Metal ZIPPERS. With jobbers too, the big swing is to Mid-States. But, why go on . . . write for the name of a Mid-States Jobber near you who can show you how metal ZIPPERS out-perform anything in the field of electric welding. Ask for new, free bulletin. Write today!

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The RIGHT FLUX for the JOB

No. 2 FLUXINE for brazing and bronze welding—copper, copper alloys, malleable iron and steel.

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No. 7 FLUXINE for welding all types of aluminum.

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No. 41 FLUXINE used with high-melting silver solders on copper and its alloys and on steel.

No. 42 FLUXINE used with Westinghouse Phos-Copper rods and low-melting silver solders on copper and its alloys.

No. 43 FLUXINE . . . non-glaring . . . used whenever low-melting silver solders are specified. No injurious fumes.

Wherever a flux is required "FLUXINE" Fluxes will do it better and more economically. Write us today on company letterhead for sample stating your Flux problem. Address Dept. G.

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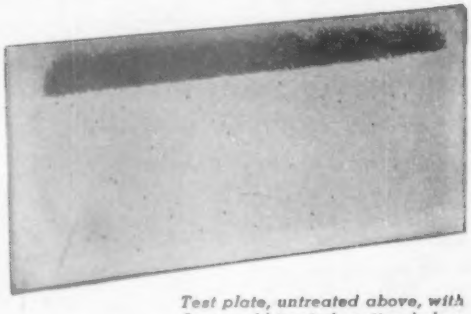
LET US *PROVE* THAT

AMCOWELD

COVER PLATES are better



Test plate, untreated above, with Amcoweld treated section below.

● We would like to send you, without cost, a special demonstration cover plate, having one section coated with an Amcoweld plastic, and the other untreated. Put it in service and see for yourself how the Amcoweld treatment sheds weld spatter—maintains clear vision longer—boosts welding footage. See why more and more weldors use the Amcoweld non-pit cover plate. Send for your free sample.

EASTERN EQUIPMENT COMPANY, Inc.

Industrial Safety Division • Willow Grove, Penna.

MANUFACTURERS OF AMCOWELD PRODUCTS

Neil J. Briehel, well known throughout the welding industry, has been appointed sales manager of the Harris Calorific Sales Co., Chicago.

» «

Henry H. Knapp has been appointed service engineer of the railway equipment division of the American Welding & Manufacturing Co., Warren, O. Mr. Knapp will follow the work of the engineering staff of the division in the design and development of a number of products being readied for car and locomotive application. He will later be available for field consultation on the installation of these devices.

Gwilym A. Price has been elected president of Westinghouse Electric Corp., succeeding **George H. Bucher,** who has resigned from that office. Prior to his election as an officer of Westinghouse, Mr. Price had been president of the Peoples-Pittsburgh Trust Co., since January, 1940, following three years as its vice-president in charge of trusts.

Mr. Bucher was elected vice-chairman of the board of directors and will continue to serve as chairman of the Westinghouse Electric International Co.

» «

Lt. Col. Charles H. Greenall, now director of research at Frankford Arsenal, will take up his duties as executive director in the Franklin Institute Laboratories on or about April 1. Col. Greenall, formerly supervisor in charge of metallic materials at the Bell Telephone Laboratories, is a mechanical engineer specializing in materials development. He will assist **Dr. Henry B. Allen,** secretary and director of the institute. **Dr. Rupen Eksergian** and **Dr. W. F. G. Swann** will act as senior consultants to Dr. Allen. Dr. Eksergian is chief consulting engineer for the Edward G. Budd Mfg. Co., and Dr. Swann is director of the Bartol Research Foundation of the institute.

» «

Edward E. Helm, general sales manager of The Reliance Electric & Engineering Co., has been elected sales vice-president of the company. Mr. Helm has been with Reliance since he graduated in electrochemical engineering from Penn State College in 1924. He is a member of the Association Iron & Steel Engineers, the Engineers' Society of Pennsylvania and the Technical Association of the Pulp and Paper Industry.

» «

R. David Thomas, Jr., director of research and engineering of Arcos Corp. since 1940, has been elected vice-president of the company. Mr. Thomas, who is a graduate of Cornell University and holder of a master's degree in Chemical Engineering from that institution, is a member of the American Welding Society, American Society for Testing Metals, American Society for Metals and the Franklin Institute.

» «

Frederick J. Bruckner has been appointed assistant manager of sales for the Chicago district of the United States Steel Supply Co., U. S. Steel subsidiary. He was formerly manager of the stainless, alloy and aircraft steels division.

» «

Neil H. Hanson, formerly with The Linde Air Products Co., has started a new welding supply business in Birmingham, Ala. The new enterprise is known as the A. C. Welding Supply Co. Office and warehouse facilities are at 1000 N. 28th St., Birmingham.

» «

C. S. Munson has been appointed assistant to general manager of sales of the Vanadium Corp. of America. He returns to the company after four and a half years of active duty in the U. S. Navy as a Lt. Commander.

» «

Albert O. Vogel, formerly lieutenant commander, U. S. Navy, has returned to The Vilter Mfg. Co., Milwaukee, and appointed assistant to the president.

» «

Ralph H. Engstrom has rejoined the sales division of the Bastian-Blessing Co., Chicago. Captain Engstrom returns after four years service in the armed forces.

Drillet Box Jig Saves Up to 75% of Jig Body Expense and Labor!

The six-sided Drillet Box Jig above and at right has a range of 125 different sizes, making it possible to accommodate all sizes up to 6" capacity—for drilling, reaming, counter boring, counter sinking, spot facing, tapping, etc.

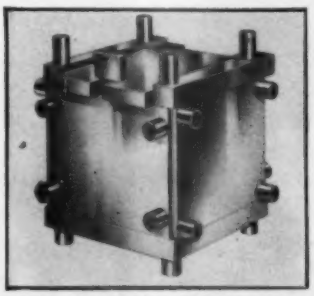
The Drillet Box Jig makes special tool design for drill jig unnecessary. Saves up to 75% of the time and cost of building a jig body. By merely turning thumbscrews and raising loaf, parts may be quickly loaded or unloaded. The jig may be used on all six sides, taking advantage of its full capacity.

Another useful product is chewing gum. You can enjoy chewing Wrigley's Spearmint Gum even while your hands are busy. The pleasant chewing helps to steady you—helps keep you alert and on your toes when you're doing a monotonous job.

Besides the satisfaction chewing gives you, it helps keep your mouth moist and fresh so you naturally feel better—and feeling better you work better.

Scores of industrial plants report that they have stepped up their workers' morale and efficiency by making chewing gum available to them.

You can get complete information from The Chicago Drillet Corporation, 920 S. Michigan Ave., Chicago 5, Ill.



Drillet Box Jig in Locked Position

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•

EFFICIENT

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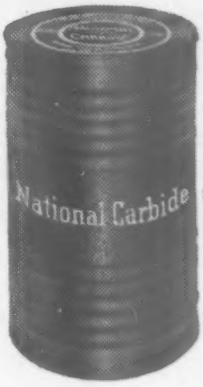
DEPENDABLE

•



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Welding and Cutting
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Write us for information as to nearest available stock.

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WHEELRITE All-Welded CYLINDER TRUCKS

Meet all tank handling requirements

For Safe, Easy handling and transporting of tanks for jobs in both shop and field, use dependable WHEELRITE All-Welded Cylinder Trucks. Sturdy all-welded angle iron framework — Hefty one-piece tubular steel handles — Large, wide flanged easy-rolling steel wheels.

Available in three sizes to provide for every type cylinder and unit used in welding.

Illustrated:
Wheelrite No. 1— Provides for the two largest size tanks of oxygen and acetylene. 18 inch wheels.

Send for illustrated circular.

Distributors wanted.

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"ANTI-BORAX"

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No. 1 Cast Iron Welding Flux.
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Send for Free Samples

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HOT TIPS?

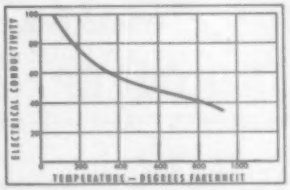
Adjust-A-Cold Tube

The curve illustrates temperature versus conductivity, showing the decrease of conductivity in welding tips as the temperature is increased. "Hot Tips" mushroom, further decreasing effective current due to the increased area of contact.

The problem of "Hot Tips" can only be solved by the most effective application of water cooling. Short circulating tubes create insulating steam pockets on the inner-surface of the tip. Overheating is the result.

Adjust-A-Cold holders utilize a circulating tube adjustable to the depth of any length tip. This design has completely overcome the problem of "Hot Tips" by releasing the water at the extreme end of the circulating channel. Steam pockets are thus eliminated and highest efficiency and longevity for the tip are obtained.

Write for full information on proper tip control.



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"Unusual Alloys for Unusual Applications"

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New Low Priced
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716 LOW-MELTING ALUMINUM BRAZING ROD

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for Faster
CAST IRON BRAZING

1 Fear of overheating can be forgotten.
2 Cleaning and grinding are unnecessary, because it penetrates through grease, oxides, etc.
3 Chipping is unnecessary. A satisfactory bond can be obtained on oxidized surfaces.
4 Deteriorated cast iron can aways be welded with "York's 77"

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3349 OGDEN AVENUE CHICAGO, ILLINOIS

YORK'S 77
CAST IRON BRAZING FLUX

Irving C. Brown, formerly sales manager of Thomson-Gibb Electric Welding Co., has been appointed sales manager of the industrial electronics division, Raytheon Manufacturing Co., Waltham, Mass. He brings to Raytheon a wide range of experience in advertising, sales promotion and service activities. Mr. Brown is a native of New Hampshire and a graduate of Wesleyan University.

» «

E. R. McClung, Jr., former welding engineer with the New York Shipbuilding Corp., Camden, N. J., has joined the staff of Lukenweld, Inc., Coatesville, Pa., as welding engineer. In his present position, Mr. McClung will be responsible for procedures, techniques, training and new developments in welding.

» «

Thomas P. Moran, formerly welding engineer at the Ternstedt Mfg. Division of Fisher Body Corp., has been appointed Detroit manager of Precision Welder and Machine Co. His headquarters will be located at 6432 Cass Ave., Detroit 2.

» «

Jack Green, former assistant sales manager in Chicago for Tube Turns Inc., has been appointed sales manager of the corporation's welding fittings division. Succeeding Mr. Green is **Tom Pike,** a specialist in refinery and oil equipment, who was prior to his affiliation with Tube Turns an engineer salesman for W. R. Guiberson Co.

» «

I. Kagan of Hercules Electric & Mfg. Co., Inc., is back at his post as sales manager in charge of the Herco A. C. Welder department after three years absence in the southwest Pacific.

» «

Frederick H. Newhardt, formerly with General Electric Co., has been appointed sales manager of the Industrial division for Eastern Metal Products Co. The company has recently increased its capacity for the molding of aluminum and other non-ferrous materials.

» «

Died . . .

Dr. Harry F. Waite, pioneer X-ray developer, died January 26, following a long illness. Dr. Waite was president of the Picker X-Ray Corp., and Waite Manufacturing Division, Cleveland.

» «

Robert L. Gordon, a vice president and director of the Pullman-Standard Car Manufacturing Co., died February 12 in St. Petersburg, Florida. He was in charge of the company's sales in New York. Mr. Gordon was also a vice-president of the Pullman-Standard Car Export Corp.

NEW LOW TEMPERATURE ELECTRODES

EutecTrode 28

A Coated Electrode for the Metallic Arc Welding of Bronze, Brass, Copper

For reduced production costs—can be used with AC and DC — deposits sound welds with good corrosion resistance — a close color match to red bronzes and yellow brasses—tensile strength 45,000 psi.

Bronze Castings welded with EutecTrode 28. This is the first electrode developed that can successfully weld copper, brass and bronze with an AC-DC metallic arc. Completely machinable, perfect color match, high tensile strength.

Take advantage of these improved EutecTrodes:

24—for cast iron—no preheat—AC-DC
24B—for cast iron—AC-DC
30—for copper—AC-DC
2100—for aluminum alloys—DC

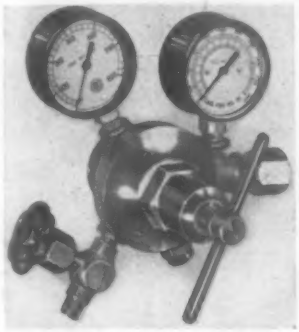
and these EuteChroms:

2—for hard overlays on worn parts — AC-DC
4—for work-hardening overlays—AC-DC
6—for overlays on tool steel—AC-DC
8—for high hardness, impact strength — AC-DC
12—for extremely hard overlays—AC-DC

EUTECTIC WELDING ALLOYS CO., New York 13, N. Y.

Originators & Pioneers in Low Temperature Welding Rods & Fluxes

FREE Complete new booklet on fabricating with EUTECTIC Low Temperature Welding Rods.



Nageldinger Style "N" 608 Regulator for delivery of pressures up to 500 lbs. p.s.i.

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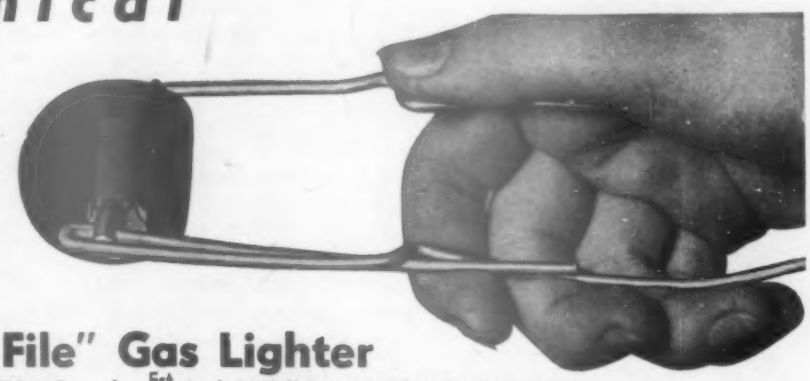

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MOVING AHEAD ON YOUR JOB

By Richard P. Calhoon
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This amazingly practical and authoritative book shows how you can start now to place yourself NEXT IN LINE FOR PROMOTION and *headed for future success!* It shows what present-day business requires of *you*, gives dozens of pointers and tells how you can apply them to overcome your shortcomings, shows how to make good on what you do *so as to stand out in competition with others.* Do you want to *be there* when the promotions are handed out? Then send for this stimulating and helpful book today; see exactly how it prepares you to capitalize on your merit, win respect and promotion on your job.

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Here is a practical manual bringing you the 11 simple, workable methods of dealing with people that business leaders use. The book tells what to say and do in your everyday contacts with others in order to win their friendship, good-will, and cooperation. The methods are clearly demonstrated in numerous stories of real people of today, and together form a direct, easy-to-understand, easy-to-use technique for improving your relations with others and especially for securing better results in training, directing, supervising, and other elements of successful leadership.

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"From The Patent Office"

(Continued from Page 82)

Electrode Holder

2,389,569. **Henry J. Wagner,** Jackson, Mo. Filed Feb. 16, 1944. Issued Nov. 20, 1945.

An electrode holder with upper and lower tong members. Upper tong member includes a solid jaw having an integral shank projecting from the inner end. Shank has a forward portion reduced in width to provide a depending ear and a rearwardly and upwardly extending rear portion. An insulating handle is fitted on and completely encloses the rear portion of the shank. Lower tong member includes a jaw having a shank integral with and projecting from its inner end. The shank of the lower tong member projects inwardly beyond the shank of the upper tong member and includes a narrow outer portion provided with a longitudinal recess to receive the ear of the upper tong member. A pivot extending through the ear and the shank of the lower tong member connects the tong members, and a helical compression spring is interposed between the shanks to urge the jaw of the upper tong member into engagement with the jaw of the lower tong member. Spring is seated at one end in the insulating handle and at the other end in a wide recess in the top of the shank of the lower tong. An adjustable bushing threaded through the shank of the lower tong member receives the lower end of the spring for adjusting the tension of the latter. A conductor is secured in the socket of the lower tong.

» «

Weldor's Helmet

2,390,006. **Lawrence A. Severy,** Southbridge, Mass., assigned to **American Optical Co.,** Southbridge. Filed June 8, 1942. Issued Nov. 27, 1945.

A weldor's helmet comprising a face-protecting portion, to which is pivotally connected a headband supporting structure. Band structure has overlapping end portions, one of which engages the head and has flangelike members extending outwardly of the side in parallel relation with each other. A block is secured between the flanges to produce a slideway for receiving the opposed end portion of the band. The opposed end portion of the band has a number of spaced notches adapted to be engaged by a latch lying within a slot in the block. Latch is so arranged as to permit the notched end portion to move freely in a direction inwardly of the slideway and to engage an aligned notch to restrict movement in the opposite direction.

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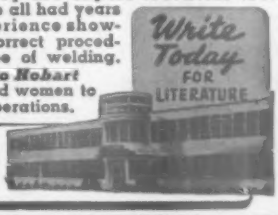

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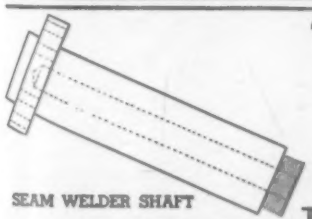

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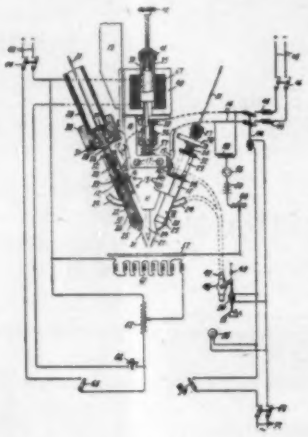
Atomic-Hydrogen Torch

2,393,199. **Gareth G. Somerville,** Pittsfield, Mass., assigned to the **General Electric Co.,** Schenectady, N. Y. Filed March 6, 1943. Issued Jan. 15, 1946.

An atomic-hydrogen torch comprising an electrode holder, an electrode-holding collet and electrode-adjusting screws making a threaded engagement with one another and having electrode passageways. The latter passageways are aligned with one another and with the electrode passageways through the collet and holder. One of the adjusting screws makes a threaded engagement with the holder and acts on the collet. The other adjusting screw has a means for holding an electrode in its longitudinal passageway and a means for rotating the electrode-holding adjusting screw relative to the collet-engaging adjusting

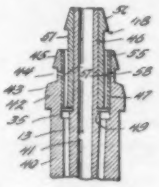


screw to feed an electrode lengthwise by the electrode-engaging surfaces of the collet.

» «

Cutting Tip

2,392,593. **Alexander F. Jenkins,** Baltimore, assigned to **The Alexander Milburn Co.,** Baltimore. Filed Feb. 2, 1944. Issued Jan. 8, 1946.

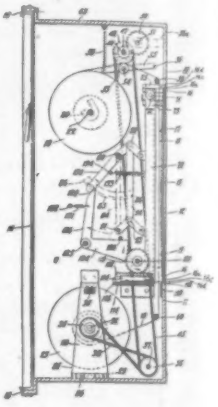


A torch tip having a one-piece body portion provided with an axial oxygen passageway and an annular series of combustion-gas passageways opening through discharge orifices in the front end of the tip. An annular recess is formed in the rear end of the tip, and the central portion of the tip body extends rearwardly as a relatively narrow tubular projection. An annular insertable member fits snugly within the recess but terminates short of the forward end to provide an annular chamber. The insertable member is provided with a series of gas-admission passageways leading to the chamber, function of which is to equalize the distribution of gases to the passageways in the tip body. The insertable member also extending rearwardly to fit tightly the tubular axial projection, with which it is coterminous.

» «

X-Ray Cassette

2,391,191. **Frank T. Powers,** Glen Cove, New York. Filed Nov. 24, 1942. Issued Dec. 18, 1945.



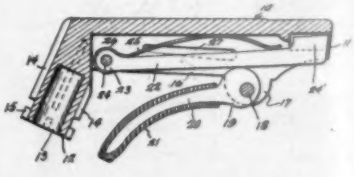
A cassette for X-ray radiography with provision for handling and exposing successive portions of a long strip of ray-sensitive material. The cassette comprises a casing having a curved flexible-wall portion forming an exposure window. A clamping means within the casing moves into and out of a predetermined position in order to press a measured length of the strip into substantially planar engagement with the wall for exposure to X-rays through the window. The strip is severed by a means within the casing operable upon movement of the clamping means out of the predetermined position.

» «

Electrode Holder

2,390,997. **Hardick F. Fuller,** Portland, Ore. Filed Sept. 12, 1944. Issued Dec. 18, 1945.

This holder consists of an all-metal, sheath-like unit comprising a longitudinal shank forming the sheath proper and including parallel slotted side flanges.



The outer end of shank is fashioned into a stationary electrode-accommodating jaw. The opposite end of the unit is formed with a lateral cylindrical extension provided with a socket to accommodate a lead-in and provided on its ex-

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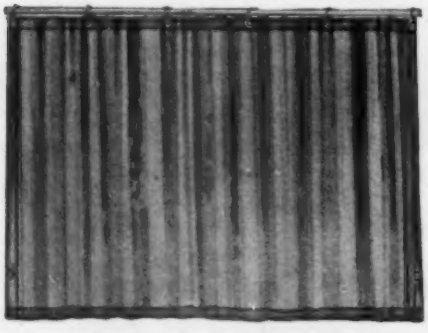

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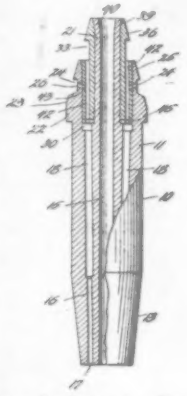
terior with radial, circumferentially spaced spacing ribs. A lever having an eye at its inner end is pivoted in the sheath between the side flanges; the lever is provided at its free end with a laterally projecting grooved head constituting a movable jaw to coact with the stationary jaw. A flat spring having one end coiled around the eye bears against the adjacent part of the sheath, and its free end bears against the adjacent outer end portion of the lever. The flanges are provided with parallel ears, between which a cam is eccentrically pivoted. Cam is engageable with the adjacent edge of the lever.

» «

Cutting Tip

2,392,386. **Alexander F. Jenkins,** Baltimore, assigned to **The Alexander Milburn Co.,** Baltimore. Filed Jan. 11, 1945. Issued Jan. 8, 1946.



A torch tip having a main body portion provided with an axial oxygen passageway and an annular series of combustion-gas passageways opening through discharge orifices. The passageways lead from an annular recess formed in the rear end of the tip body. An insertable annular member fits snugly within the recess but terminates short of its forward end, thus providing an annular chamber forwardly of the member. The annular member is provided with a series of gas-admission passageways discharging into the chamber in order to equalize the distribution of gases to the passageways in the tip body. A series of radial grooves are formed in the forward face of the insertable member; each groove intersects one of the discharge openings of the gas-admission passageways.

» «

R-W Actuating System

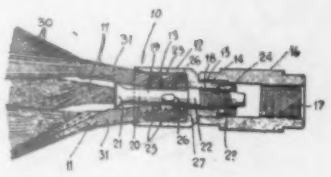
2,392,296. **Melvin M. Seeloff,** Warren, O., assigned to **The Taylor-Winfield Corp.,** Warren. Filed April 13, 1944. Issued Jan. 1, 1946.

In a resistance-welding machine, the combination of means to effect movement of at least one electrode and to apply welding pressure. Elements are: a hydraulic-fluid motor connected with the electrode, a source of hydraulic fluid under pressure, a conduit to connect with the motor in order to actuate it to apply an initial welding pressure, a discharge conduit, a normally open valve and a pressure-loaded relief valve in series in the discharge conduit. As determined by the loading of the relief valve, the hydraulic fluid under pressure may move through a substantial portion of the first conduit and through the discharge conduit. There is also a power-operated means to close the normally open valve in order that the kinetic energy of the hydraulic fluid under movement in the first conduit may be translated into pressure surge in the motor to increase the pressure exerted by the welding electrodes.

» «

Wire-Brush Holder

2,392,909. **Floyd Fogliasso,** Arlington, Calif. Filed March 9, 1944. Issued Jan. 15, 1946.



In a brush assembly for attachment to the end of a rotating shaft, the combination of a holder be connected to the shaft and a plurality of brush elements. Each of the latter consists of a plurality of strands and each has an opening at its rearward end. A core extending axially within the body defines an annular space in the recess at its forward end to receive the rearward ends of the brush elements. Core is enlarged at its forward end and has radially extending protrusions to engage the openings at the rear ends of the brush elements. There is also a means for locking the core in the body.

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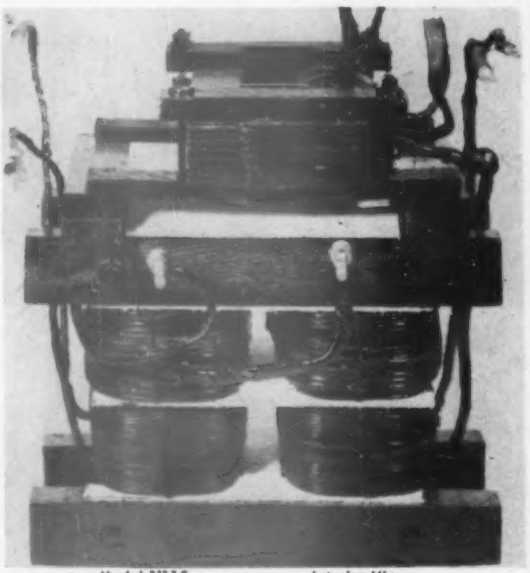

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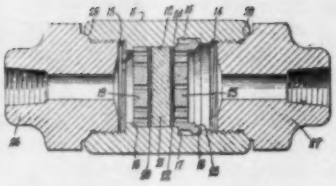

Flash Arrester

2,391,592. **Ralph C. Pierson,** Indianapolis, Ind., assigned to **Union Carbide and Carbon Corp.,** New York City. Filed May 2, 1940. Issued Dec. 25, 1945.

A flash arrester comprising a body having a chamber through which acetylene or the like is conveyed. A first shoulder is located in the inner wall of the body, at one end of the chamber. The body is grooved at the opposite end of the chamber to form a second shoulder. A perforated plate abutts against the first shoulder and forms a seal therewith, while a second perforated plate is located at the opposite end of the chamber. Flash-arresting material is placed within the chamber between the plates. A retaining means is deformed into the groove and engages the second plate to hold the plates and material in the chamber so that the material cannot be replaced without destruction of at least a part of the flash arrester.

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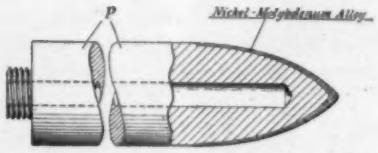


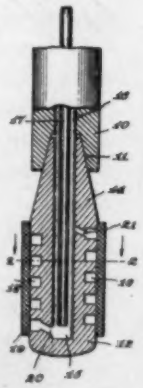
Hard-Faced Die

2,392,821. **Malcolm G. Kreag,** Chicago, assigned to **Haynes Stellite Co.,** Kokomo., Ind. Filed Jan. 22, 1944. Issued Jan. 15, 1946.

A metal-working tool having a wearing surface composed of a nickel-base alloy. The latter contains 5 to 25% molybdenum, 10 to 30% chromium and a nickel content of approximately 55 to 60%.

» «

R-W Electrode System



2,392,736. **Franz R. Hensel** and **Earl I. Larsen,** Indianapolis, assigned to **P. R. Mallory and Co., Inc.,** Indianapolis. Filed May 2, 1944. Issued Jan. 8, 1946.

A spot-welding electrode system comprising in combination an electrode holder and an electrode having depressed portions on its outer surface. A sleeve covers and seals these depressions from the exterior in order to define a cooling space without substantially increasing the electrode external diameter. Cooling fluid is passed through this space.

Wire Mesh Welder

2,390,174. **George R. Roemer,** Mount Lebanon, Pa. Filed Jan. 1, 1943. Issued Dec. 4, 1945.

Apparatus for continuously welding wire mesh. It includes upper and lower rotary electrodes and a hollow shaft on which a rotary transformer is mounted. The stay wires of the mesh are positioned across the line wires over the lower electrode. Line wires are backed up by laterally spaced cylindrical contact surfaces. Upper rotary electrode uniformly presses a stay wire against the line wires as each stay wire passes between the upper and lower electrodes. The passage of each stay wire effects a momentary energization of the transformer primary circuit while a stay wire is pressed against the line wires and contact surfaces.

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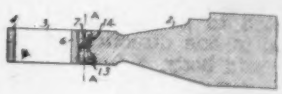

Welded Turbine Blades

2,392,281. **Robert C. Allen,** Wauwatosa, Wis., assigned to **Allis-Chalmers Mfg. Co.,** Milwaukee. Filed July 10, 1941. Issued Jan. 1, 1946.

A method of making a bladed element for turbines and the like by welding the blades to an element of a single-surfaced peripheral portion of the same width as the base ends of the blades. The peripheral portion is partially covered with a chill-ring structure. When the blades are properly positioned in rows, their base ends form with the chill-ring structure and the exposed part of the peripheral portion a laterally opening channel. This is filled with weld metal to fusibly unite the channel-forming portions of the blade ends with the peripheral portion. The chill-ring structure is then removed to form a second laterally opening channel in the opposite direction. The second channel is formed in part by the metal previously deposited in the first channel. It, too, is filled with weld metal, fusibly integrating the exposed wall portions.